The Foundry Trade Journal

AND PATTERN MAKER.

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OWING TO THE REDUCTIONS IMPOSED BY THE GOVERNMENT ON PAPER SUPPLIES, THE PROPRIETORS ARE COMPELLED TO PUBLISH "THE FOUNDRY TRADE JOURNAL" ON A THIN PAPER DURING THE CONTINUANCE OF THE RESTRICTIONS.

BRITISH FOUNDRYMEN'S ASSOCIATION.
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Manchester: J. Hogg, James Street, Radcliffe, Manchester.

Birmingham: F. E. Shearman, 29, Oliver Road, Edgbaston, Birmingham.

Sheffield and District: J. Dickinson, 157, Abbeyfield Road, Pitsmoor, Sheffield.

Scottish: J. Macfarlane, 3, Sharrocks Street, Ibrox, Glasgow.

London: Jas. Gaunt, 29, Chandos Road, East Finchley, N.2.

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NOTES AND COMMENTS.

Foundrymen's Gathering.

The Annual Meeting of the British Foundrymen's Association this year was, without reserve, a really successful gathering. The combined attractions of Sheffield and the resumption of some of the normal features of these conferences brought together nearly 200 representatives of the foundry trade from all over the Kingdom—a number far in excess of the attendance at any previous conference of the Association. Apart from being a tribute to the City and also to the personality of the new President, this wide interest is significant of the awakened national sense of the importance of technical progress. The work of the Association on educational and technical matters has been somewhat restricted in the past, but is broadening with every passing year; and the future promises to see a prominent and important place held by the Association in the ranks of the technical societies. The trade generally, we feel sure, is ready to give it ample support in any well-devised scheme for furthering the art and science of founding, and it only remains now to strike out boldly on to any of several useful lines of activity to rally round it plentiful assistance, both financial and other.

Research work naturally suggests itself as an activity of first importance, and with this we agree, provided such research is conducted on some of the many practical problems outstanding. Purely scientific investigations of a laboratory nature should be postponed for the present in favour of practical experimental investigations under works conditions for the collection of reliable data. Probably in no branch of industry is the available data so conflicting and unreliable, resulting from lack of systematic investigation and neglect to record the conditions under which such data was obtained.

The instruction of foundry apprentices is another matter to which the Association must redirect its attention. Something has already been done in this direction, but the work has not yet reached the stages of fruition. With its enlarging influence, the Association should be able to wield a great power for progress in this matter, giving the lead alike to employers, educational authorities and the trade generally.

On the subject of collecting foundry information and making it available to founders, a proposal is already before the Association, embodied in the Paper read before last month's Conference by Mr. R. Buchanan.

Information Bureau for Foundrymen.

The proposal above mentioned calls for very careful consideration, for it is an attempt to meet (at any rate partially) what has long been acknowledged as a standing difficulty in the foundry trade. In brief, it is an attempt to mobilise the nation's information on the founding of grey iron and malleable cast iron. (In passing, we think a

normal sequel to success will be the inclusion of steel and the non-ferrous alloy, however much they appear to be dealt with by other organisations.) Whether Mr. Buchanan's suggestions are practicable without serious modification or revision is subject for discussion. One difficulty lies in the cost and labour involved in the work; for the primary supporters of the scheme will probably look for distinctly preferential treatment in the distribution of the benefits arising from the Bureau's activities. At the same time, the Foundrymen's Association cannot lend its countenance, as an educational institution, to a scheme involving a select circle of firms operating an information bureau under its auspices, but chiefly for their own use and profit. We do not suggest that there are not sufficient firms of open-minded character to support a bureau for the general dissemination of foundry knowledge, for already we are aware of several generous promises of help; but we do suggest that the constitution of the bureau should be such as will encourage the widest possible utilisation of its resources throughout the country. For this reason it were well to start by establishing a clear understanding of independence, coupled with the objective of universal service to the trade.

The details of constitution are a matter for discussion between representatives of the Association and any firms or individuals who can promise definite support, at least in the initiatory stages. We suggest that all firms interested forward their preliminary suggestions and promises of help to the Association's Secretary, so that the subject may have the early consideration its importance warrants.

Co-operation between Capital and Labour.

THE Industrial Reconstruction Council, of which Mr. Wilfrid Stokes is president, and Mr. F. H. Elliott hon. secretary, has issued a manifesto, urging that co-operation between capital and labour is undoubtedly the most urgent industrial question of the day, and that an exceptional opportunity now occurs to take a practical step in the establishment of better relations. In the Council's opinion the innumerable connections between the Government and the trades give an opening which may never occur again to establish the principle of co-operation between labour and capital upon a sure and sound foundation. The opposition to our proposal (the manifesto says) will probably come chiefly from employers who have not grasped the full significance of the new spirit in industry. As a matter of fact, employers no less than employed have a great deal to gain from such an arrangement. Their position in relation to the Government would be immensely strengthened by the co-operation of labour in matters which many of them have hitherto regarded as outside the scope of joint action. The opportunity for the course which we suggest will pass with the war, as the relations between the Government and trade are then expected to become less intimate. We, therefore, press for the immediate acceptance of the following principle:—That any commercial or industrial matter ought not to interest the Government unless it interests both capital and labour, and the consequent adoption of the following policy:—That the Government will undertake to obtain and, wherever possible, accept advice on these matters from bodies equally representative of both labour and capital.

Post-War Non-Ferrous Possibilities.

SPEAKING at the annual meeting of the Zinc Corporation Limited, recently, Mr. F. A. Govett dealt with the metallurgical position. In the production of lead, he said, the progress of the Associated Smelters was of the greatest importance. The capacity of the plant was more than twice as large as it was when they took it over, and they could now turn out per annum 160,000 tons of lead, 5,000 tons of spelter and zinc dust, and, say, 10,000,000 ozs. of silver. This country produced from native ores but little lead, while it was one of the largest consumers of lead for its manufactures. In spite of that, the price in England had not only been controlled, but controlled at a figure which at times had been as much as 50 per cent. below the prices which had been allowed to rule in other markets. "The question of the formation of a company to erect zinc smelters in England (he continued) has not yet matured, although it has been under the close consideration of other parties here as well as of our Australian group, and beyond the expansion of existing works and progress with the erection of works at Avonmouth nothing has been done. Already some of the existing works, even with their small capacity, are not in full operation now for want of material, and it seems probable that this condition may be prolonged for some time after the war is over. As a matter of fact, I think that this question of the erection of smelters is only shelved, and probably not for long, for those interested in the great galvanising and brass industries of this country must be viewing the outlook with much apprehension, unless there be some promise of big smelters working here or elsewhere within the Empire. America and Japan have both enormously increased their output not only of copper, but also of zinc, and with these increases of raw material there has been, with war demands, a vast expansion of their output of manufactures of brass, which seriously threaten the position of English manufactures in the post-war trade. The same is true of galvanising If this country, with its poor supplies of non-ferrous metals and heavily interested in their manufacture, is to retain her predominance in the markets of the world, especially in the Eastern markets, she must have supplies of metals smelted and refined within the Empire."

Maximum Prices of Lead.

The Ministry of Munitions inform us that, as from June 28, the Lead Order, 1917, will take effect as if in the schedule opposite to the respective classes of lead set out in the first column following, the figures set out in the second column following were substituted for the figures set out in the third column following:—

Class of lead.	New figures.	Original figures.
	£ s. d.	£ s. d.
Sheet lead	41 0 0	39 10 0
Lead pipe	41 10 0	40 0 0
Dry white lead	51 0 0	46 0 0
White lead in oil	58 0 0	53 0 0
White lead in oil	60 0 0	55 0 0
Red lead and litharge	45 0 0	42 0 0

This Order is cited as the Lead (Amendment) Order, 1918.

Small Tools Order, 1918.

The Minister of Munitions authorises every person, until further notice, to manufacture for his own use, but for no other purpose, any of the small tools referred to in the above order.

Applications for licences to manufacture small tools for other purposes are to be addressed to the Controller of Machine Tools, Charing Cross Buildings, London, W.C.2, and marked "Small Tools."

British Foundrymen's Association.

Annual Meeting at Sheffield.

The fifteenth annual meeting of the British Foundrymen's Association was held at the Cutlers' Hall, Sheffield, on Friday and Saturday, June 21 and 22.

In every respect the gathering was highly successful, and in this respect was very gratifying as indicating the general approval of the reversion to provincial conferences which have necessarily been suspended during the progress of the war. The attendances were remarkably good, and the dinner which took place at the Grand Hotel on Friday night was attended by about 160 members, and a number of influential guests. The very prevalent impression throughout the Conference was that the Sheffield meeting will inaugurate a new period of greatly increased membership and much wider usefulness in the history of the Association.

Mr. J. Ellis, the retiring President, presided at the opening proceedings at the business meeting on Friday morning, and welcomed the members to Sheffield, remarking that from the larger attendance it was evident the meeting would be a great success.

Mr. J. Dickinson (Sheffield), who acted as General Secretary in the absence of Mr. E. A. Pilkington, announced apologies from Professor Campion and Messrs. Allbut, Reason and Aitken.

REPORT OF COUNCIL.

The report of the Council for the past Session was as follows :—

Notwithstanding the many duties and distractions inseparable from the prosecution of a great war, the General Council is glad to report that the Branches are doing excellent and valuable work. Many interesting papers have been given and discussed. Visits to various works have been much appreciated by the members, though such visits have been much less in number than usual owing to the war conditions obtaining everywhere. The Council hopes to start a Branch at Bradford during the coming session. Five members of the General Council are retiring according to rule and are eligible for re-election. The following members have been nominated :—W. F. Bagnall, Sheffield; *H. Jewson, East Dereham; *T. Macfarlane, field; *H. Iewson, East Dereham; *T. Macfarlane, Horsehay; *J. Oswald, London; *H. L. Reason, Birmingham; M. Riddell, Glasgow; J. Shaw, Dudley. (* Retiring members.)

The General Council is pleased to report an increase of membership at the present time. This shows that during a period when many Associations have suspended operations, appreciable interest is being taken in our Association. The respective Branches have the following members attached to them :—

	Members.	Associate Members.	Associates.	Total.
Birmingham ...	27 (12)	77 (76)	54 (47)	138 (135)
East Midlands...	25 (21)	40 (44)	17 (27)	82 (92)
Lancashire ...	46 (33)	112 (90)	28 (27)	186 (150)
London	56 (44)	55 (61)	6 (11)	117 (116)
Newcastle ...	39 (29)	63 (57)	29 (30)	131 (116)
Scottish	47 (37)	98 (95)	49 (56)	194 (188)
Sheffield	52 (46)	83 (83)	13 (18)	148 (147)
Unattached ...	31 (39)	31 (30)	— (8)	62 (77)
Totals ...	323(261)	559(536)	176(224)	1058(1021)

(The figures shown in brackets are last year's figures).

The total number of members on the roll of the Association is 1,058, against 1,021 last year; 9 members, 53 associate members, 67 associates, making a total of 129, have resigned or ceased to be members; and 71 members, 76 associate members, 19 associates, making a total of 156, have been elected. The General Council notes with satisfaction the steady increase of full members, and also the transference of associates and associate members to higher grades.

In common with similar Associations, we have to place on record the losses we have sustained by the war. Many of our members are serving their country, and several have laid down their lives for the cause. For those still at the front we wish a happy return at an early date, and for those who have made the supreme sacrifice we give our lasting gratitude.

To complete the Roll of Honour, the General Secretary will be glad to make the necessary additions if names omitted now are forwarded to him.

The accounts for the year ended December 31, 1917, are herewith submitted, having been duly audited by Messrs. Frank Creke, Harcourt & Company, Birmingham, the auditors appointed at the annual meeting.

INCOME AND EXPENDITURE ACCOUNT from 1st January to 31st December, 1917.

Expenditure.

	£ s. d.	£ s. d.
Postages		37 15 5
Printing and stationery, including printing of Proceedings		167 12 9
Council finance and annual meeting expenses		11 6 11
Branch expenses, viz. :—		
Lancashire	17 18 2	
Sheffield	17 6 9½	
Scottish	22 6 8	
Newcastle	28 3 11	
Birmingham	18 9 10½	
London	22 8 2	
East Midlands	15 5 8½	
		141 19 3½
Illuminated addresses		5 0 0
Audit fee		4 4 0
Clerical assistance		12 10 0
Incidental expenses		21 0 3
Honorarium to secretary		42 0 0
Royal Charter		1 1 0
Balance—being excess of income over expenditure		73 10 8½
		£518 0 4

Income.

	£ s. d.
Subscriptions received	501 17 2
Sale of books, etc.	3 2 0
Interest on War Loan	13 1 2
	£518 0 4

BALANCE SHEET, 31st December, 1917.

Liabilities.

	£ s. d.	£ s. d.
Subscriptions paid in advance		44 3 6
Sundry creditors		123 9 8
Surplus as at 31st December, 1918 ...	207 5 3½	
Excess of income over expenditure for year ending 31st December, 1917	73 10 8½	
		280 16 0
NOTE—There are arrears of subscriptions amounting to £130 7s. which are not included in these accounts.		
		£448 9 2

ASSETS.	£ s. d.	£ s. d.
Cash in hands of Secretaries, viz.:		
Lancashire	11 8 11	
Birmingham	2 6 10	
Scottish...	5 10 6	
Sheffield	7 10 3	
London	4 18 3	
East Midlands	11 0 8½	
General Secretary	18 8 9	
	61 4 3	
Less due to Newcastle Secretary ...	3 9 10	
		57 14 5
London City and Midland Bank, Limited		39 11 2
Furniture, fixtures and fittings		18 13 6
Investment Account—		
War Loan at cost		332 10 1
		£448 9 2

E. A. PILKINGTON,
Gen. Secretary.
F. W. FINCH,
Hon. Treasurer.

We have examined the above balance sheet with the books and vouchers of the Association, and find same to be in accordance therewith.

FRANK CREKE, HARCOURT & CO.,
Auditors,
23, Colemore Row, Birmingham,
15th May, 1918.

The Report and accounts were adopted on the proposition of MR. R. BUCHANAN, seconded by MR. H. SHERBURN (Warrington).

Election of Officers.

Mr. T. H. Firth was elected President, on the proposition of the retiring President, seconded by MR. F. J. COOK (Birmingham). The latter speaker remarked that Mr. Firth had already gone far beyond their expectations, and he was glad of the personal share he had had in the installation of Mr. Firth as one of the Vice-Presidents. He would make an ideal head of the Association.

The election was supported with great acclamation, and MR. FIRTH briefly thanked the members for the cordial welcome he had received.

Mr. John Little (Sheffield) was elected Senior Vice-President on the proposition of the PRESIDENT, seconded by MR. W. MAYER (Past President), both speakers referring in very complimentary terms to the energetic work done by Mr. Little in connection with the Sheffield Branch, and on the General Council.

On the proposition of MR. W. MAYER, seconded by MR. R. BUCHANAN, Mr. M. Riddell, of Glasgow, was elected Junior Vice-President. Mr. Mayer described the nominee as a most enthusiastic foundryman and an able metallurgist. He was sure Mr. Riddell would do credit to himself and bring distinction to the Association.

MR. RIDDELL, acknowledging, predicted that the Association would very soon come to the front. The war had not only enormously developed the iron trade, but had shown the great need for Association.

MR. F. W. FINCH, of Gloucester, was enthusiastically re-elected Treasurer, on the proposition of MR. C. JONES (Cardiff), seconded by MR. S. A. GIMSON (Leicester).

MR. FINCH, replying, mentioned the fact that £250 had been invested in War Loan, and £100 in Bearer Bonds. The bank-book showed a balance of £386 2s. 9d., and after certain prospective payments, which would be voted at that meeting, they would still have a balance in hand of £291 2s. 9d.

The PRESIDENT (Mr. T. H. Firth) paid a tribute to the work done by the retiring Secretary (Mr. E. A. Pilkington) during the past five years. Latterly certain duties compelled him to be frequently away from home, and made it therefore increasingly difficult to meet the growing demands of the Association upon the Secretary. They therefore accepted his resignation with regret.

MR. S. A. GIMSON proposed the acceptance of the resignation, and a tribute of thanks to Mr. Pilkington for services rendered, also the granting of an additional honorarium of 20 guineas as an appreciation of his services during his period of office.

MR. COOK seconded, and the PRESIDENT explained that this sum would be in addition to the 40 guineas which it had been customary to give to the Secretary.

The resolution was carried.

The PRESIDENT proposed the election of Captain Alexander Hayes (London) as Secretary.

MR. MAYER seconded, and, the proposal having been supported by MR. GIMSON, it was enthusiastically carried.

Messrs. Cook and Buchanan acted as scrutineers for the election of members of the Council, and it was subsequently announced that Dr. W. H. Hatfield and Messrs. J. Shaw, H. L. Reason, J. Oswald and H. Jewson had been elected. The Auditors and Trustees were also re-elected.

MR. T. H. FIRTH
(*President of the British Foundrymen's Association*).

New Membership Form.

The meeting proceeded to discuss a proposed new membership form, and MR. J. G. CROWTHER, of Sheffield, proposed to insert the declaration by an applicant that he was of British birth and parentage.

MR. A. L. KEY (Nottingham) pointed out that the Association included some Frenchmen, whom it was very undesirable to exclude.

MR. CROWTHER said he would have no objection to such a modification as would admit the Allies of the Empire to membership.

MR. VICKERS (Birmingham) pointed out that it

was always in the power of a Branch to exclude a nominee of German origin.

After further discussion, a resolution was carried referring the matter to the Council for reconsideration, with a view to the adoption of such a form as would carry out the spirit of Mr. Crowther's proposal by the exclusion of enemy aliens.

The proposed instructions for the management of Branches were next considered and adopted with certain minor modifications.

Presidential Address.

Mr. T. H. Firth proceeded to deliver his presidential address as follows:—

One of the foremost and most important aims of our Association is education, and I wish to speak of this on very broad lines, in order to impress the employers, and the work-people, that one of the first things we must do as a nation, is to see that everything is done to bring about a better feeling all round.

Men should have continuity of employment; this I think is one of the most important points we have to consider. I cannot see that it is fair for any employer to be able to go to any particular class of men who have been working well and doing their duty, to give them, say, a week's notice just because the firm happens to be short of work. To get this, we want Government co-operation—not Government control—and I feel sure if all were to pull together, something could be worked out which would ensure some sound scheme.

My idea is that it could be easily arranged for every man to be guaranteed a minimum wage, but not a maximum, which should be big enough for him to keep his wife and family respectably. The working hours should also be reduced, so that he has time for study, recreation, or any other form of enjoyment he most likes.

In return for this, the workman must give of his best with no restrictions, so that every man who wishes can earn considerably over the district rate for any particular trade. It should, of course, be clearly understood that piece-work prices must be arranged so that this can be done, and that prices in no way must be cut.

Both employers and employed will certainly have to be educated to see clearly that they are both interested in the same way, and what is good for the employer is also equally good for the employee. If these points could be carried out, restriction of output, which I look upon as one of the greatest dangers to the industrial stability of the country, would be impossible. We should then find that the high cost of living and other expenditure would be reduced, and this is surely the only method of our meeting foreign competition, which will have to be seriously faced at the termination of this terrible war.

Specialisation is certainly one of the things we, as founders, will have to go in for. There are too many foundries known as jobbing foundries; some of these will always be wanted, but generally speaking, we must specialise if we are to compete.

We cannot do this alone, but must get the engineer, designer, and constructor to work with us, so that if, say, a turbine casing or a motor of a certain type is wanted, some general design for the particular size can be agreed upon for all the country, which would enable standard patterns, boxes, etc., to be made, so that quantities could be ordered at one time, and if necessary stocked. By this means productions would be increased, cost very much lowered, and supervision lessened. We need no greater lesson in specialisation than the Ford motor car, the chief reason for the low manufacturing cost of which is—rigid standardisation, close organisation, and attention to details. Production in Great Britain will certainly have to increase to enable us to obtain the same standard of life that we are having at present.

It has often been said that moulding is an objectionable trade, and that some boys do not like it on that account; I think perhaps there is something in this. You, however, never saw—any more than myself—a dirty moulder in Germany, and in this we must copy them. All foundries and engineering works should certainly be supplied with lavatories and cloak rooms, so that everyone could wash and change, or take off overalls. This, I know, has been tried—with not very satisfactory results—in some works here; but if we begin with the apprentice when he first comes to the works, he will certainly grow up to appreciate little comforts of this kind.

We must try and educate the workers to place more trust in their employers, and with this in view my own firm has started a Supervisor to see to the welfare of the boys. Our object is not only to help them in their work, their education, and their sports, but to teach them self-reliance, to regard the welfare of others, and their duty to their King, Country, and Empire.

And, gentlemen, what a vast amount does this involve! We have had a noble inspiration in the splendid presentment of Imperial Unity given to us during this Great War. What a glorious spectacle of whole-hearted Union and perfect solidarity of the British people—alike in the Motherland and throughout the far-reaching possessions of our peerless Over Sea Dominions.

This country, we are told on every side, can never be the same again as it was before the unprecedented conflict through which we and our gallant Allies are now fighting, towards the Great Victory, which will secure for the nations a righteous and permanent peace. The unity of our people in the stern ordeal of battle must lead to a far larger measure of unity than before in the paths of trade and commerce.

We must remember, and apply the lessons this war teaches us—to be more and more a self-contained Empire than we have ever been, to secure all that is possible in industrial and manufacturing productions *within* the Empire, and to make sure, after the full and vigorous development of our own vast Imperial resources, that the nations with whom we are fighting hand in hand, shall at the very least, have full consideration over those whose aim has been lust of conquest and world domination.

How this can most effectually be secured is noble work for the best brains of our own and allied peoples. The great duty before us as a nation, and an Empire, is to do the work that is nearest our hand, and to do it thoroughly. There must be no foolish adherence to old worn-out shibboleths, but ready, full, and enlightened recognition of the changed conditions brought about by this tremendous upheaval among the nations, and in our country, employer and employed must more and more realise the imperative need for the closest

possible harmony in working, the lightening of labour wherever possible, and the thorough resolve to secure the fullest production in the essentials of the world's industries, under the best obtainable practical conditions for those who are engaged in the work.

The valour and endurance of our men at the front have been vigorously backed by the unwearying and tireless energy of the men at the foundry and the furnace, and by men and women alike in the workshops of the country, and there is increasing confidence everywhere that the lessons of self-sacrifice, self-denial, and recognition of the rights and duties of all, whether employers or employed, will lead to still brighter days in the great realm of industrial Britain. Let each of us do our part to bring about this much-to-be-desired result, and there will assuredly come those brighter conditions wrought in the glowing furnace of this world war.

To the splendid foregatherings of our own people in the Home Land, and the mighty young nations beyond the seas, who have so gloriously rallied round their dear Mother Country, has come the noble race whom we are proud to welcome as of ourselves. Every day adds to the strength of their forces by sea and land, and they have already given, and will continue to give, brilliant proof of their power and their prowess in the mighty struggle of Right against Wrong, of Freedom and Humanity over Tyranny and Frightfulness.

Let us all look forward with firm faith and resolute determination for the coming of the sunshine of peace, with victory for the great cause which has brought the Anglo-Saxon peoples of England and America into perfect line with their gallant Allies of France, Italy, Belgium, and other lands along the far-flung battle line.

Let us all look forward to a triumphant issue of the conflict, in the full conviction that once again we shall hail and rejoice in the truth of what the poet of old declared:—

> For Freedom's battle once begun,
> Bequeathed by bleeding sire to son,
> Though baffled oft, is ever won.

On the proposition of Mr. Ellis, seconded by Mr. Gimson, a hearty vote of thanks was accorded the President for his address.

Medal for Papers.

Mr. Oliver Stubbs (of Messrs. Joseph Stubbs, Ltd., Manchester) announced that for some time he had considered what he could do to create general interest in the work of the B.F.A., and he was prepared to give a sum of money to be invested in such a way as would furnish a medal for presentation every year to the writer of the best paper during the year, on terms and conditions to be settled by the Council. (Applause.)

The President said that they would all appreciate the great kindness of Mr. Stubbs, and the offer of that medal would stimulate harder work in order to obtain it. He proposed a hearty vote of thanks to Mr. Stubbs.

Mr. F. J. Cook (Birmingham) seconded, remarking that for some time the Council had felt that something of that kind ought to be done. They started by giving diplomas for the best papers in each Branch, but that was only a modest beginning. The generosity of Mr. Stubbs would entirely coincide with the ideas in the minds of the Council.

The resolution of thanks was heartily carried.

Votes of Thanks.

On the proposition of Mr. Winterton, thanks were tendered to the retiring President and the officers for their work during the year. Mr. Stubbs, in seconding, mentioned that a new Association entitled the National Ironfounding Employers' Federation had been formed very successfully, and it was hoped it would be found possible to link up with the British Foundrymen's Association by some kind of co-operation. It was intended to approach the B.F.A. with a view to a joint educational propaganda. There was obviously scope for a great deal of that sort of work. The speaker pointed out that the real success of the Association depended upon the energy of the local Branches. He thought the success realised during the past year was greater than could have been expected in a time of war.

Mr. Ellis, in acknowledging the compliment, said there were great signs of activity in all the Branches and a general feeling that henceforward the Association would go forward with greatly accelerated progress.

The meeting then proceeded to the consideration of the Papers on the programme, the first being "The Fluidity of Molten Cast Iron," by Mr. Matthew Riddell (Glasgow). The Paper appears elsewhere in this issue.

At the conclusion of the discussion the meeting adjourned.

Entertainment and Visit to Works.

After the morning meeting the members were entertained to lunch at the Grand Hotel by invitation of the Committee of the Sheffield Branch. Following the lunch and the usual loyal toasts, the health of the Sheffield Committee as hosts was duly honoured, a special tribute being paid to Mr. Crowther, the President of the Sheffield Branch. The toast was briefly acknowledged by Mr. Crowther.

In the afternoon the steel foundries, etc., of Messrs. Thomas Firth & Sons, Limited, Norfolk Works, Sheffield, were visited in response to the kind invitation of the Chairman and Directors. The works are of a very extensive character, employing now about 14,000 workpeople, as compared with 4,000 before the war. The visitors were shown armour castings, hull castings, and many descriptions of marine-engine parts required for H.M. Navy, more particularly marine valves, as well as heavy steel castings required for large hydraulic forging presses and steel castings for built-up flywheels for rolling-mill plant up to 40 tons each in weight. The plant includes two Héroult electric steel furnaces with capacities respectively of 4 tons and 8 tons of metal. The party witnessed the pouring and casting of 4 tons of metal, the ladles being conveyed to the casting boxes by means of a 100-ton travelling crane. A tour of the gunshops was also made.

Afterwards the members were entertained to tea by the directors, and a hearty vote of thanks was accorded the hosts, on the proposition of the President, who paid a tribute to the great work that was being done by the firm of T. Firth & Sons in connection with the war. He also pointed out that he himself was not connected with the firm. His company was the Brightside Foundry & Engineering Company.

Mr. Bernard Firth (Chairman of Thomas Firth and Sons) thanked the meeting for the vote, stating that the firm regarded the visit as a very great compliment. There was never so much

necessity for the study of practical production and for the cultivation of harmonious relations between all parties. They would be only too pleased to show individual members of the Association in their private capacity over the works. Possibly the firm had done more than many other firms in research work, and he wished them to understand that in any way they would be glad to contribute to the general benefit of the industry.

During the progress of the visit, Dr. Hatfield, who is in charge of the laboratory jointly carried on by John Brown & Company and Thomas Firth and Sons, Limited, conducted a party of about 20 over the laboratory. Nearly an hour was spent in the examination of the apparatus and appliances, special attention being given to the elaborate apparatus for microscopic work, pyrometry, testing machines, etc. Dr. Hatfield explained the normalising work that was done and the difference between the results obtained from optical and pyrometrical operations. The visitors expressed themselves greatly interested in all they saw.

In the evening the members were entertained to dinner at the Grand Hotel, on the invitation of the President, Mr. T. H. Firth.

The Dinner.

About 160 members and guests accepted the invitation to dinner, the visitors including the Lord Mayor (Alderman Alfred Cattell), the Master Cutler (Sir William E. Ellis, C.B.E.), Engineer Commander Mark Rundle, R.N., D.S.O., Mr. J. Rossiter Hoyle, J.P., Dr. W. Ripper, Dr. Arnold, Mr. J. M. Allen, Mr. Ambrose Firth, Professor Fearnsides, and several well-known leaders of Sheffield industry. In addition to the loyal toast, Mr. S. A. Gimson proposed "The City and Trade of Sheffield," which was responded to by the Lord Mayor and the Master Cutler; Mr. Matthew Riddell proposed "The Army and Navy," which was responded to by Engineer Commander Mark Rundle; Mr. J. G. Crowther proposed "The Visitors," to which Mr. J. Rossiter Hoyle responded; "The British Foundrymen's Association" was proposed by Dr. W. Ripper and responded to by the President.

Mr. Firth, in his response, expressed the hope that the membership would greatly increase during his year of office. He considered the present total of 1,058 much too small.

Mr. Finch, referred to as the founder of the Association, mentioned that five of the original seven members who joined him in the initiative proceedings were present. He felt very proud of the large results which had come from the humble beginning.

SECOND DAY'S PROCEEDINGS.

The Conference resumed on Saturday morning, when the proceedings opened with a paper by Mr. T. Brown (Sheffield) on "Deformation of Castings." Mr. T. H. Firth again presided.

In order that this paper and discussion may be printed in full it is being held over until our next issue, owing to considerations of space.

National Information Bureau for Foundrymen.

Mr. R. Buchanan (Birmingham) read a Paper on "A National Information Bureau for Foundrymen," an abstract of which appears on page 360.

Mr. R. Carrick (Shipley) called attention to the fact that the question dealt with in the Paper was raised by himself and by Captain Hayes at the general meeting of the Association held in London in June, 1915, when he submitted a resolution to the effect that a strong committee selected from the best men of the Association be formed to collect and distribute information to foundrymen for the benefit of the Association and the country generally. He was then informed that the matter would be taken up during the current year. Subsequently he got a letter from the Secretary, Mr. Pilkington, inviting his views on the question, and he wrote a number of notes for submission to the Council. But he had heard nothing since. He would be glad to know what the Council had done in the matter.

Mr. S. A. Gimson (Leicester) pointed out that Mr. Carrick's question was hardly in order. They were there to discuss Mr. Buchanan's Paper, and any question as to what the Council had done must be dealt with as general business later on. There was no point in the inquiry, because the present Paper had not been sent forward by the Council.

The President supported Mr. Gimson's objection and invited the meeting to discuss Mr. Buchanan's Paper.

Mr. H. L. Reason said that, as a member of the Provisional Committee appointed by the Department of Scientific and Industrial Research to organise research upon co-operative lines for the non-ferrous metals industry, he was quite in sympathy with Mr. Buchanan's suggestion of a National Information Bureau for Foundrymen. He would like to point out, however, that if a bureau could be started on the lines suggested it could do research work of the highest order by collecting all available information on the main troubles which occurred in the foundry. This would form the basis of the important research work that was so urgently wanted for the trade. Until all existing information had been collected and properly tabulated it would be a waste of money to commence a number of definite researches. The vast amount of information which existed as to the many problems of ironfounding would, when properly mobilised, prove a surprise to the foundry trade generally. The statement by Mr. Buchanan that the proposal of a National Information Bureau for Foundrymen anticipated the Birmingham scheme by six or eight months showed how keenly alive were both the ferrous and the non-ferrous industries to the necessity. As to the financial aspect of the question, a British Non-ferrous Metals Research Association was being formed. It would consist principally of manufacturers, who would pay subscriptions based upon working capital and wages paid. The Government would contribute annually an amount equal to that subscribed by the trade, but only for a limited period, perhaps five years. To start an information bureau under the auspices of the British Foundrymen's Association it would be necessary to secure financial support from manufacturers. A surprisingly large amount of work had already been carried out by the Research Department's Standing and Departmental Committees. A large proportion of the £1,000,000 set aside by the Government for research had been devoted to the purposes of other industries. Therefore, if the ferrous and non-ferrous metal trades did not wake up very soon they would find that there was no money left to assist them in the important work which they would have to tackle in the near future. With reference to what had been called the lost arts, we had samples of work made before the Christian era and at later dates in the past which we had

not been able to equal, and there was still being lost every year a large amount of information which, if it could be preserved and made available, would be of valuable service to various trades. For example, the demand for certain goods for some special market would be so great and apparently so constant that a very high degree of excellence in the manufacture of those goods would be obtained; but suddenly, through change of custom or fashion, the demand would cease and the manufacture would drop, and probably become more or less a lost art. In such a case, if the demand revived a number of years later, a properly organised information bureau might save manufacturers an enormous amount of money by enabling them to resume where their forefathers had left off. No doubt some of the highest arts in connection with our manufactures were lost every year owing to the lack of proper institutions for storing the knowledge. Mr. Reason concluded by suggesting that a small committee be formed to study the matter thoroughly in all its aspects.

Mr. W. H. Aston (London) expressed his pleasure that the matter had already been considered at various Branches of the Association, because they might depend upon it that if Scotland, Sheffield and Birmingham put their approving seal on the proposal it would go through. He (Mr. Aston) in June, 1916, was present at a Council meeting when he expressed the view that the foundryman needed some kind of text-book or manual of practical foundry work which would help him in his business at the present time and not five or ten years hence. He was then told the thing was impossible. He then discussed the matter with the present Secretary, with the result that that gentleman evolved a complete scheme embodying pretty well all that Mr. Buchanan now advocated (as well as other matters), and that was printed and put before the Council. The Council then thought it was premature to discuss it during the war. His own idea when Capt. Hayes brought out the scheme was that it was too advanced for the moment, but would prove to be all right for the future. Obviously they wanted to cultivate the working man and get him into the fold. But they were not going the quickest way about it. What he thought they ought to do was to form a committee and produce something of a practical character applicable to working foundrymen. What they required immediately were practical results. Take, for example, the cupola, common to most foundries. They greatly needed investigation and improvements which would at once reduce cost and speed-up production. He thought they ought to form a committee immediately and get to work at once. (Applause.)

Mr. J. Shaw said he had listened to Mr. Buchanan's Paper with great interest, and while fully in agreement with the object in view they needed to be quite sure that the information collected was generally accepted and proved. As an instance of that necessity, they had seen during the Conference how divergent were the views held by Dr. Hatfield and Mr. Riddell in relation to what took place during the melting of iron as illustrated by the equilibrium diagram. Such cases might be multiplied *ad lib*. Even on the practical side the information sent in would have to be supplemented by stating the conditions prevailing at the time. For example, if they had two cupolas melting a high semi-steel mixture of the same chemical contents it was quite possible, as he had found from experience, for one to be more than 0.5 per cent. less than the other in the total carbon. That was due to fast and hot melting, the resulting product being a success in one case and a failure in the other. The customs and conditions of different foundries varied so much that information from one founder was not always suitable for another. For example, if they took the simple core for the 18-lb. gas shell, some firms would swear by the oil-sand core, while others were equally successful with ordinary core sand. In view of those differences, he did not see how they were going to cut out the research side of the question.

Mr. H. J. Young (Wallsend-on-Tyne) thought that no better plea for an information bureau could have been put forward than that embodied in the general discourse of the last two speakers. He thought the Council should add its efforts to those of others in an endeavour to persuade the Government to devote a more reasonable sum of money than one million pounds to industrial science and research—say, ten millions. Meanwhile the scheme could develop by the voluntary work of members themselves, and it appeared to him that the Council, instead of waiting for the Government, might act upon the idea that those who assist themselves are never without assistance, and are also most likely to attract it.

Mr. M. Riddell (Glasgow) quite agreed with the last speaker that prevalent divisions showed the necessity for the Bureau. Cast iron as a study had been neglected almost entirely by men of science, and there was very great need for an extension of scientific interest in that subject. He had been struck with the different attitudes displayed towards the Paper. In Scotland, when Mr. Buchanan put forward his suggestions they were heartily approved, and the only diversity of opinion was as to whether the Bureau should be under national control, should be in one central office or in various districts. Some people objected to national control because they did not think that that meant efficiency. His own view was that that was a job for the B.F.A. to do at once. But obviously it could not be done without a large sum of money, and as an Association they were not wealthy people. But they might do a certain amount of missionary work, and already they had individual employers and combinations who would be able to place sums of money at the disposal of the Bureau. He thought they ought to send out missionaries, thump the drum well, and get foundrymen and their employers interested in the scheme. The present exigencies had opened the eyes of foundrymen and employers throughout the country to the importance of scientific work and scientific control of the foundry. One Association he was connected with had already appointed a Research Committee, and he was certain any such scheme promoted by the B.F.A. would command support and sympathy. No one would be more suitable than Mr. Buchanan to arouse general interest in the scheme. In certain centres they had already made a start. In Glasgow they had founded an information bureau which had been at work for over a year. They had joined with different scientific societies, such as the Institute of Metals and the West of Scotland Iron and Steel Institute, and had compiled a catalogue of valuable literature in Glasgow for the different branches connected with founding and the working of metals. The University, Technical College, and several different institutions having libraries had combined to compile that very useful catalogue, which was put into book form, and it was

made available for any members subscribing to the various societies. The result was to place at their disposal a fine range of literature on iron. The catalogue was divided into sections, one dealing with aeronautics and another with certain branches of engineering, and they had a special one devoted to books on ironfounding. They were able to borrow books from the Iron and Steel Institute and get out the books from the libraries by virtue of their membership of the B.F.A. There seemed to be no reason why other Branches should not make a start and so form a small nucleus of the Bureau. He would like to see the different Branches at once commencing some such scheme as a beginning, remitting the bigger question to the General Council to set on foot some missionary enterprise which would bring in the requisite funds. He was quite sure that that money would be willingly given when the donors were satisfied that it would be spent in the right way.

Mr. R. Garrick (Shipley) assured the meeting that he had no desire to make any derogatory reflections upon the Council or to regard personal considerations. They were greatly indebted to Mr. Buchanan for bringing before them that admirable presentation of the matter, and he thought there was an almost unanimous opinion that something on those lines ought to be done, and he was very well pleased that there was a prospect of some substantial result. He thought it was an excellent suggestion that the Branches should take up the matter, and he felt that if anything was done it could not be done by the present meeting. A Committee should be appointed with the object of putting the matter before the whole of the members. A circular outlining the scheme should be sent out, and inviting suggestions and nominations to a committee. They had only one object, to do the best for the Association and the country.

Mr. Cook proposed that the Council be instructed to form a sub-committee whose special duty should be to formulate a scheme for submission to the members.

Mr. Aston (London) seconded.

Mr. R. Buchanan said that the resolution referred to as having been brought before the Council never came within his own knowledge, nor was it brought before him. He was really quite indifferent to the question of personal credit for any proposal put forward, and was only anxious for the scheme to go forward for the general good. He now remembered Mr. Hayes' proposition, but, whether through design or forgetfulness he could hardly say at that moment, he certainly never referred to it either when he wrote the paper or since, although that was obviously a preliminary duty. Anyhow, he gladly gave Mr. Hayes credit for the work he did. He had quite a good recollection of Mr. Aston's proposal, though that was not quite on the lines of the Bureau now suggested. His idea was that Mr. Aston rather wanted something of an encyclopædic nature, so that if a member had a particular difficulty all he had to do was to turn up a certain page and find a solution. There was no such volume in existence, and he did not think there was any possibility that it would ever be in existence. It would take a score of men to prepare such a volume, and in a very few years it would be largely out of date. He did not see the possibility of any man or number of men having valuable time to spare to get up such information. No doubt it was quite true there was a great deal of matter in libraries, but when they studied that matter it really boiled down to his own Information Bureau project. He was rather disappointed in what Mr. Reason told them about Birmingham, because he particularly wanted to know what had been done with regard to the financial arrangements. However, no doubt he had sufficient reasons for not going into those details. Probably they should have to work out their own salvation. If the meeting desired such a committee as had been suggested, he (Mr. Buchanan) would gladly welcome it.

The Secretary (Captain A. Hayes) said that he wished the meeting to understand that Mr. Buchanan's proposal had his hearty support and fullest appreciation. He could quite realise that owing to the circumstances in which his own (the speaker's) proposals were put forward Mr. Buchanan did not bear them in mind. The necessity for some such organisation was impressed upon him by the number of founders he met who were constantly encountering difficulties due to a change in the nature of their work, resulting from war requirements. From the earliest days of the war he had received applications from men who desired to be brought in touch with sources of information regarding the new classes of work that were being distributed all over the country, and any scheme which would help in that matter commanded his earnest approval and support. With regard to other functions embodied in the scheme to which Mr. Aston referred, those were not covered by Mr. Buchanan's proposal, and could be left for future consideration. He (the speaker) would be delighted to see Mr. Buchanan's proposals brought before the Council for immediate consideration.

The President put Mr. Cook's proposition authorising the scheme to be carefully considered at the next Council meeting with a view to a subsequent report to the Branches.

The resolution was carried.

In view of the lapse of time it was found impossible to consider the Paper by Professor A. Campion, F.I.C., on "Notes on the Influence of Some Special Constituents on Cast Iron." The Paper was accordingly taken as read, and discussion by correspondence invited.

The Conference was concluded with expressions of thanks. The President expressed the hope that the members had had a good time in Sheffield, and he could assure them that the Sheffield Branch had found real delight in entertaining them.

Mr. S. A. Gimson proposed a hearty vote of thanks to the President and to the Sheffield Committee for the excellent way in which the Conference had been carried through. The attendance had been a surprise, and he was quite certain that the information they had gained would prove of permanent value. They were looking forward to great things under Mr. Firth's presidency.

Mr. R. A. Miles (Manchester) seconded the resolution, which was carried.

The President, in a brief acknowledgment, expressed a strong hope that they would all help to the utmost extent in securing an increased membership.

Hearty thanks were accorded to the authors for their papers.

The shareholders of the Brightside Foundry and Engineering Company, Limited, have approved of the proposal to increase the capital from £85,000 to £125,000 by the capitalisation of £40,000 of the accumulated profits.

A National Information Bureau for Foundrymen*

By R. Buchanan, Birmingham.

There are very few persons in business, or connected with business in Great Britain to-day whose thoughts do not, at least occasionally, turn to the conditions which will probably obtain in the world after the conclusion of peace.

The loss of multitudinous young lives will remain a lasting grief even on public grounds, and a still greater sorrow for those whose sons or brothers have nobly laid down their lives for you and me. It is unnecessary, I believe, to say more on this point, because our hearts are so full of gratitude and words are too weak to express our feelings. We are sincere in our sorrow if we are not noisy and demonstrative.

After the war what kind of a world is it going to be? There is a general concensus of opinion that so far as trade is concerned the competition betwixt the manufacturing nations will be more intense than ever.

There are questions with which we could deal, questions of almost surpassing interest, but I propose to confine myself to one subject of considerable importance, though of minor importance when compared with others one could readily mention.

The financial burdens we shall have to carry, if for no other reason, make it necessary that nothing be left undone so that our handicap may be as light as it possibly can be made.

The proposal which I am now putting before you for a "National Information Bureau for Foundrymen" is one which is almost non-controversial, I believe. It calls up no party feelings, and interferes with no vested interests. It is a question of the best means to adopt to obtain the desired result.

It is a suggested method by which national waste will be lessened, waste of time, waste of money and waste of material so far as foundries are concerned. For the moment I am dealing with private, not public waste, though waste of private money reacts on the amount of public money available, just as truly as waste of public money has a very direct effect on the amount of private money available for private use.

There has always been waste in foundries just as there has been waste in other sections of engineering effort, but it is my hope that this waste can be lessened if the proposal which I now have the honour to place before you is brought to fruition.

During the war I have had a very considerable experience of foundries doing war work, and while the class of work and the requirements attached to that work were not of a usual kind, one could not but be impressed by the appalling waste of money, private money, which went on. This arose from various causes; one was want of knowledge by the authorities of what was really required as indispensable qualities in the parts wanted; another was the giving of instructions by those in authority who themselves were ignorant of the effect of their instructions; and, thirdly, the ignorance of those who had to carry out the instructions and "to deliver the goods."

It appears to me to be a national waste that so many firms all over the country should be carrying on experiments in production and most of them coming up against the same dead wall. That is one of the penalties pertaining to our exaggerated individualism. However advisable or necessary such individualism may have been in the past, one does not need to be a prophet to predict that after-the-war conditions will not permit it to anything like the same extent. Even before the war sections of our trade found themselves by conditions at home compelled to sink their prejudices and dislikes and to link their interests with those of their competitors. While this was, no doubt, of benefit to the associated firms, it admits of little doubt that the country as a whole also benefited. If the pooling of interests was a necessity before the war, still greater will be the necessity after the war.

Now I am not interested for the moment in the pooling of anything but such knowledge and information as will be of service to the foundry industry. We are fortunate in being connected with an industry that is certain of being permanent and regarding which there is no finality of knowledge or experience.

During the past ten years the British Foundrymen's Association, together with practical men and scientists, has done a fine educational work towards a better understanding of the difficulties and intricacies of founding. These difficulties are innumerable, sometimes of the greatest perplexity, and the solving of the puzzle oft-times calls for more insight, knowledge and power of observation than are at the moment available.

For the man engaged in actual, practical, foundry work some technical knowledge is a valuable accessory to, but not a substitute for, a practical training. My suggestion is not to teach practical foundry work, but to mobilise all the available sources of knowledge so that the information so gathered may be available for use by founders throughout Great Britain and her dependencies.

In December last a meeting was held of the Birmingham brass trade to consider a proposal of a very similar kind as that which I am now putting before you, but it was quite local as regards the area to be catered for, and was for the brass trade only.

I may say here that my proposal for a "National Information Bureau for Foundrymen" was suggested six or eight months before the proposal was made to have a local Bureau for the Birmingham brass trades. I mention this simply to avoid misapprehension as to the origin of the present proposal.

The meeting in Birmingham was addressed by Mr. W. R. Barclay of the Non-Ferrous Section of the Ministry of Munitions, and his exposition of the functions of such a Bureau is so excellent that I take the liberty of borrowing parts of his speech. The arguments and illustrations he uses are in most cases applicable to national as well as local ends, and perhaps more so. By a national scheme one gets away from the local and personal prejudices which are such a hindrance to progress.

[The author then proceeded to quote at length the views put forward at a meeting of the Birming-

* Read before the British Foundrymen's Association, Sheffield, June 21 and 22, 1918.

ham Section of the Institute of Metals, on the proposal to form a "Non-Ferrous Trades' Bureau of Scientific and Industrial Research," the concluding part of the quotation being as follows.]

"A concrete proposal might be outlined as follows:—One hundred firms might join an Association on the lines of an Association put forward in the Second Annual Report of the Department of Scientific and Industrial Research. Each firm might contribute, say, £50 per year. The Association would have its centre in Birmingham. It would be managed by a Committee of Manufacturers. Its staff would probably consist, first, of a Technical Director, whose assistants, he would suggest, should be three or four well-educated women, possibly University graduates. Their first step would be to collect and house in the office in Birmingham a library as complete as it was possible to obtain of non-ferrous technical and scientific literature, English and Foreign. At the same time arrangements would be made for the purchase of every periodical which either closely or remotely touched the industry concerned. The Director would appoint correspondents in every centre where the industry was carried on, thus keeping the centre in close touch with all sources of information. Correspondents could be got from every part of the world, and we might keep also in close touch with some of our Allies. Touch would be established with every technical college in the kingdom and every University dealing with matters of interest to the trade.

"Further, a firm might discover a process not particularly useful to itself, but which if communicated to the trade as a whole would be of tremendous value. In that case it would be the duty of the Director to collect all such communications and keep in touch with the work carried on in technical schools and colleges, properly arrange and index, and, if he thought fit, a confidential bulletin might be prepared and sent out, giving a complete list of communications or information from whatever source obtained. Every firm would then see exactly on what subjects the Bureau had new or special information, and could then communicate with the Director and obtain what was available."

Mr. Buchanan then followed with an extract from the Eleventh Annual Report of the Executive Committee of the British Science Guild, on the promotion of scientific and industrial research. The extract in question, he said, showed that the objects, admirable as they are, set out and to be partially financed by the Research Committee, were not exactly those which he, the author, had under review. He continued:—

The foundry industry certainly provides ample room for research, but at the moment it is not the most clamant need. What is more immediately required is the making available for use by founders of the very large mass of information already in existence, but for various reasons not within reach of the persons who are, or ought to be, most interested.

Leaving aside the fact that some of this information exists only in French, German and other foreign text books, we have been distinctly remiss in having so little used our own technical literature. One does not find fault with the National Physical Laboratory because of any slackness, or undervalue the fine work it has done, but the quota of work done for the foundry industry is, so far as I am aware, very much less in amount that what some more privileged industries have obtained.

Under the scheme of the Research Committee, National funds, plus local funds, are made available for research. But the information so obtained is to be put at the service only of the firms contributing money to the local scheme. To my mind such a method for encouraging research is too parochial, and in fact is exactly what is done in parochial affairs. I think the scheme is wrong from a national point of view. We must think nationally, not individually, not even of communities. We organise a national army for war. Why should not technical knowledge also be organised nationally? In the commercial and economic war which will soon follow the present war we cannot afford to enter it as a chaotic mob. We would only meet the fate that mobs meet when brought into conflict with a well-disciplined and well-equipped army. I need not labour this point: the facts, and the deductions therefrom, are sufficiently obvious.

What are the hindrances to a complete co-operation in collecting, diffusing, and using the available scientific, technical and practical knowledge which exists?

The greatest hindrance of all is apathy and ignorance of what scientific and technical knowledge can do for the founder. The other hindrance is that, as already mentioned, we are too individualistic.

If we do not obtain commercial mastery we must at least attain commercial equality. In commerce, as in war, the best-equipped army will win if other conditions are equal. Not to equip ourselves when we can readily and at so little cost do so, is suicidal. It will probably be useful if we consider for a short time what the Germans did in this direction in pre-war days. At the present time it is unnecessary to enlarge on German capacity for organisation, either in trade or war. They were and are unscrupulous in both; but there were certain methods in trade which were admirable in intent and manner of carrying out. Methods which were not admirable, not worthy of our following, I leave out of account. If we cannot succeed by honourable and open use of our national genius, then we must fail honourably. No kind of success is of any use to us other than what is obtained by straight and above-board dealing. On the other hand, if we are to succeed, we must not handicap ourselves by exaggerated individualism and the holding of too conservative ideas. A man might as well pride himself on the antiquity of the machines in his machine shop as pride himself on the antiquity of his ideas and knowledge. I am inviting you and others to scrap the old, so far as it is simply old, and to use the new ideas to be freely put at your service.

German Organisation.

Henri Hauser says: "When two Germans meet they always look round for a third compatriot, so that they may together found a gymnastic or choral society." Hence we get a conception of competition, not a struggle of individuals against individuals, but of groups against groups. Monsieur Huller in 1900 pointed out Germany as an instance of "what a nation can do which has known how to place that marvellous tool—science allied to technique—at the service of a tenacious will."

Sir Robert Hadfield said in 1912: "It is in the laboratories of Essen, Berlin and Gross-Lichterfelde that Germany wins her industrial victories. It is the brain of the Universities and Technical

Schools which makes Germany powerful in the markets of the world."

In Germany the title of "Doktor," and in particular that of "Professor," are real titles of nobility. He is a power, and is the *obligatory auxiliary* of the public services and the great industries.

There you find no contempt for science as applied to industry as is too common here. They also have their "Information Bureaus," as also had Austria, where interested firms and individuals could apply for, and receive, the latest and best information obtainable about the particular matter in hand.

German and Austrian Information Bureaux.

(Extracts from letter from T. Vickers, Esq., C.E., Birmingham. He has considerable Continental experience.)

"The whole of the large iron and steel works belong to an Association, which we will call a Bureau. This governs matters both technical and, to an extent, commercial. All information gathered by the Bureau is common to all. Take items in the commercial line first. Agents in foreign countries report as to the output, quality, and price of all products in those countries. Samples of these products are obtained, and are analysed, and such information is at the disposal of all the firms interested in the Bureau.

"Now take the technical side. Whatever improvement in process of manufacture, or in treatment or finishing of a product is made, is subject of a report by the particular works and sent to the Bureau. The Bureau makes a report as to its practicability for home trade, and its possibility to increase foreign trade.

"Here come in the Foreign Agents' reports. They get a confidential report as to any new improvement, and have to report to the Bureau (1) If it is in use in their country. (2) If it has a sale or will increase the sales. All this is then tabulated in a wonderful short space of time and distributed.

"I give you an example—Some few years ago some of these Austrian firms found that by increasing the chrome content steel could be made into rolls for cold rolling. (Of brass, I presume.) They, however, had great difficulty in hardening the roll. Another firm, after receiving the preliminary data from the Bureau, found the chrome content was too high, and sent in their results to the Bureau. The result was that within a very short time the Bureau issued a report that chrome steel rolls for colding rolling were a commercial success, and firms making these could guarantee a resistance to crushing of 370 tons per square inch. The Bureau issued this statement based on data supplied by two firms. The result was that within a few months these rolls made their appearance in this country, and are in use to-day. During the war we have tried to make these chrome steel rolls. We can take them up to a certain point, but there we stop. If we had a Bureau that could sift the data of the firms in this country which have tried the making of these rolls, it is quite possible that a solution could be found.

"What I found was, that no firm had a secret. What was found out was considered to be for the benefit of the country's trade."

In this country the only "Information Bureaux" of which I am aware relate to one subject only, viz., horses, their pedigrees, histories and performances.

We are thus brought face to face with the tremendously important fact that we have to think and act as a nation with national ends in view. Each must leave his "lone furrow" and co-operate with his neighbours. This is somewhat foreign to our ordinary national characteristics, but is forced upon us by the circumstances of the war, and the intense international competition which will follow the war. In addition, if it were nothing else, our financial burden will compel us to national economy in every direction even were there no other compelling force.

Scope and Function of the Information Bureau.

My idea of the Information Bureau is that, at least, in the first instance, it should not itself engage in research work. For some years it would have ample work to do in collecting, cataloguing, and disseminating the information at present available. This would be obtained from books, pamphlets, lectures, articles in the technical journals, and last, but not least, would obtain, wherever that is possible, personal advice and help of someone with experience of the particular difficulty with which help is required.

For the latter purpose a list of names would be kept of men engaged in founding in the various branches where something more than written information was required; then one or more of these men would be asked to give their personal help.

For this purpose the country would be divided into areas, and a small committee be appointed for each area.

If in a difficulty requiring help, the founder would write to the Bureau, and if it appeared necessary, then the Bureau would request the local committee, either in whole or in part, to deal with the difficulty.

If there was reluctance on the part of the founder for local men to help, then the Bureau would have to deal direct with the matter, or possibly by help from a distance. In either case the founder so helped, or tried to be helped, would pay the necessary outlays, if he were not a subscriber to the funds.

A few years ago one would have hesitated to propound such a scheme, but we have learned in these latter days that more is to be gained by co-operation of effort than by division.

I believe that there would be little difficulty in securing these local committees. My experience of foundrymen of all classes makes me certain that it will be a happiness and a privilege to be able to help their fellows. Whenever I have asked help for myself or others I have never been refused. For those who are too shy or too proud to ask for help I have no remedy.

A not unimportant part of the work of the Bureau would be the investigation of the usefulness, or otherwise, of the various materials submitted for use by founders. It would be its business to see how far the claims made are justified, and to give an opinion in the matter. It would probably not be difficult to get a firm to make the necessary trials, and to make a report of their experience with the material in question. If there were a difficulty in getting a firm to make the trials, and the seeming importance of the material warranted it, then the Bureau would make arrangements for the trials to be made. The results obtained would then be communicated to all founders interested in the particular line of work in which the material would be used.

To a very considerable extent this would elimi-

nate fraudulent practices, and cut down extravagant claims for the particular panacea. As it is now, firms all over the country may be trying experiments, and in each case find there is nothing in the material of real use in the foundry.

Later on a useful function of the Bureau would be the distribution throughout the trade of extracts from Consular reports as regards likely fields for the pushing of trade both in our Colonies and elsewhere.

Under What Auspices is the Bureau to Work and How Should it be Financed?

There is little doubt that did the finances allow of it, the Bureau could do its best work, do it most efficiently, were it run largely under the auspices of the British Foundrymen's Association. If largely under the control of this body it would be free from much of the red-tape and routine which has brought so much disrepute to some Government Departments.

The contributors of funds would necessarily also be represented on the committee controlling administration.

Under the Birmingham Scheme for a Bureau for the non-ferrous trades it was proposed to have 100 firms, each giving £50 per annum. This means an annual income of £5,000. It has to be borne in mind that they mean to equip and staff a research laboratory.

Staffing the Bureau.

I yield to no one in admiration for University Professors, Lecturers, and Technical Teachers, but for the Director of such a Bureau very exceptional qualities and experience are required.

It is an absolute requirement that he and the Assistant-Director should have had considerable practical foundry experience. Not only so, they must be well grounded in the theoretical and technical part of founding, so that they may help those deficient on that side. When a problem came before them they would discuss it, and failing a solution by the Local Committee, either the Director or Assistant-Director would attend to it personally. It does not follow that even then a solution would be found, but these steps would be the best way to obtain a solution.

I would begin with these two, and the necessary clerical staff, and would recommend that no appointment be made to extend over 5 years without confirmation at the end of that period. I do not propose that we deal with the steel trade, or non-ferrous trades. These are apparently to be adequately helped by other agencies. I suggest that meantime we deal only with grey and malleable iron.

Fees.

I have come to the conclusion that a scheme wholly supported by Government is not within practicable expectation, and so I make no estimation of how such a scheme could be applied.

Under a part-voluntary and part-Governmental scheme, contributing firms would get assistance free of cost. So far as the Local Committee is concerned, out of pocket expenses only would be paid by the Bureau.

As regards non-contributing firms a small fee would be charged for advice by letter, and out-of-pocket expenses for personal visits.

The fee for advice by letter is to ensure that the person writing has really something which interests him, and that he is not simply the owner of a postage stamp.

It may be objected that the above terms are too favourable for the non-contributor, but it has to be remembered that we are living in a world which is in a state of flux and flow. It is my hope that such a scheme as this will be one agency towards solidifying our trade into one composite but homogeneous body.

After, say, three years of work on the lines I have suggested, the Bureau could enter on research work. The intervening time is not too long for the educating of founders, so that they may realise the value to them of technical knowledge and information.

[Discussion of this proposal appears on another page in the report of the British Foundrymen's Association Conference.]

PULVERISED FUEL FOR STEEL.—According to a Paper by Mr. H. R. Collins, for the Colorado meeting of the American Institute of Mining Engineers in September, temperatures ranging from 1,900 to 3,500 deg. Fah. are possible with pulverised coal fuel. The highest temperature he has observed was 3,500 deg. in an open-hearth furnace, the temperature of the furnace itself ranging from 3,100 to 3,200 deg. His experience with various grades of coal leads him to believe that any carbonaceous fuel in solid form, from lignites to the graphitic anthracites of Rhode Island, yields its maximum heat if burned in a truly pulverised condition. Such fuel permits the maintenance of a constant temperature, because when the fuel and air have once been properly set and the furnace brought to its proper temperature the established conditions will continue. Automatic control of fuel and air to maintain desired temperatures permits a minimum of excess air, he having obtained as high as 17 per cent. CO_2. Coals with 25 per cent. ash and 5 per cent. sulphur give no trouble in metallurgical furnaces, kilns or boilers, the sulphur being entirely consumed by burning in suspension and none of it being absorbed by the metal or other liquid bath. For the above uses, however, coal having 35 per cent. volatile matter, 50 per cent. carbon, 8 per cent. or less of ash and 2 per cent. or less of sulphur are preferable. For certain types of burners part of the air is preheated in regenerators, this preheating ranging from 100 to 600 deg. for a "positive" type burner and from 1,300 to 2,200 deg. for a single type burner in open-hearth practice. In the latter usually 10 to 15 per cent. of the air enters with the fuel and 85 to 90 per cent. from the regenerators. In metallurgical furnaces, experience seems to point to the need of vertical baffle walls, where the waste gases enter the regenerative chambers, so as to discharge the dust tangentially, allowing the major part to settle in the bottom passages, from where it is easily removed. The narrow side of the brick tile should be laid vertical and on rider walls to permit the use of longitudinal scrapers to remove the ash which may have passed by the vertical baffle wall. The life of a furnace using pulverised fuel is equal to that of hand-fired, stoker, oil or gas-fired furnaces. Savings using pulverised fuel in the operation of various furnaces have been obtained as follows:—Heating and bushelling furnaces, 20 to 25 per cent.; puddling furnaces, 30 to 35 per cent.; and open-hearth furnaces compared to gas producers, 30 to 40 per cent. In other furnaces the following fuel consumptions were obtained:—Continuous billet heating furnaces, 160 lbs. of coal per ton of billets; desulphurising iron ore in rotary kilns, 296 lbs. per ton of ore; drying and nodulising iron ore in rotary kilns on a basis of 30 per cent. free moisture and 11 per cent. combined moisture, 477 lbs. per gross ton of ore.

The Fluidity of Molten Cast Iron.*

By Matthew Riddell, Glasgow.

The title chosen for this Paper is one which is meant to cover the expression of a view of the functions and operations of the cupola, which, so far as the writer knows, has not been publicly discussed.

The many varied and widely divergent views which are held by experienced foundrymen concerning the correct construction and the proper manipulation of the cupola are too well known to need recounting here.

The mere fact that, after so many years of experience and discussion, there should be still such diversity of opinion on this topic is noteworthy. It would seem to indicate that either the cupola or its process is not the simple matter it appears to be, and that some more scientific explanation than common sense provides is required for the solution of the problem.

The fluidity of cast iron depends on the amount of superheat or number of degrees of temperature over and above its freezing temperature that has been imparted to it in the cupola. The greater the superheat the greater will be the fluidity or degrees of life possessed by the metal and, other things being equal, the longer will it remain fluid to fill up the intricacies of the mould.

When the metal runs dull from the cupola and is sluggish, its degrees of temperature or life are not far removed from the solidifying temperature —it is deficient in superheat. The reasons which one may hear ascribed in the foundry for the poor working of the cupola are many and various. Some blame the air supply as too large or too strong; others would have the quantity or pressure reduced; but the majority, recognising that the coke plays a most important part in the production of heat, and knowing that the manager is prompted by considerations of economy in the use of this material, are inclined to think economy has been carried too far. To these the sure remedy is more coke. It seems but natural to suppose that an increase of coke ought to result in a larger amount of heat being developed in the cupola. No doubt it does so result, but repeated experience shows that after a certain limit of coke in the charge has been reached further additions appear to make the metal duller instead of more fluid. This and some other peculiarities of the cupola which seem to defy common-sense explanations have for a long time puzzled the writer, and the solution herein proffered occurred to him while investigating the problem in connection with "semi-steel" difficulties. Among the peculiarities which the present argument appears to solve satisfactorily may be mentioned the following, viz.: Better results are obtained in the way of hot metal when the bed coke is not well lighted above the tuyeres before the blast is put on and the first iron takes long to come down, than are got when the opposite conditions prevail. Many foundrymen have noted this peculiarity, but explanations have not been satisfying. Also it has been noted that foundry irons with high silicon are generally fluid, while irons and those with high sulphur are inclined to be sluggish when melted under similar cupola conditions. It appears generally to be taken for granted that the actual temperature at the spout of these different classes of irons is the same, or approximately so, in all cases, and that the fluidity or sluggishness of the metal is due to some inherent quality of the respective elements—silicon and sulphur.

An examination of the cupola and of its load will show that as an instrument for imparting superheat to a molten metal it is as unsatisfactory an arrangement as could have been devised. It is divided into three zones, viz., (1) the bed into which the metal flows as soon as it is melted; (2) the melting zone where the maximum heat is developed and the solid metal converted to the fluid state; and (3) the stack wherein the descending charge is being heated by the ascending gases. From the foregoing it will be noticed that the point at which the temperature is high enough to melt the solid iron is well removed from and over the basin or well into which it flows when melted. After the door of the cupola has been made up there is no combustion going on in the bed coke below the tuyeres, and therefore no heat is being generated in that quarter. So soon as the metal reaches its melting temperature and becomes fluid in the melting zone it passes rapidly away from this high-temperature zone into the basin at the bottom of the bed. In some cases, where a separate receiver is used, it passes out of the cupola altogether, and consequently cannot come under the influence of subsequent heat. What little superheat the metal may have acquired at the region of maximum temperature is largely discounted in its journey to the bottom of the cupola. Besides having to pass the tuyeres, which are discharging large quantities of cold air into the furnace, it will have to part with some of its heat to the coke which makes up the bed. If there were nothing more involved in the melting of metal in the cupola than the question of heat it would be extremely difficult to account for one kind of iron coming out more fluid, and therefore hotter, than an iron of a different class. Under similar conditions of melting all metals should have imparted to them the same degrees of heat.

It is a common belief that all substances which pass from the solid to the liquid state and *vice-versa* make these reverse changes at the same temperatures. For instance, ice becomes water when the temperature begins to exceed 0 deg. Centigrade, and water changes back into ice as the temperature begins to be less than 0 deg. Centigrade. Every substance has its own melting and freezing point which is supposed to be identical for each substance. This assertion is true of all simple bodies or of alloys which retain their components in solid solution. It is because pig or cast iron is an exception to the rule that the cupola is practicable at all as a melting instrument. If any of the materials which adhered to the rule were melted in the cupola they would probably resolidify in the bed, or at the best would come out of the cupola so dull as to be useless for casting purposes, owing to the lack of superheat or life.

To investigate the behaviour of cast iron in the cupola and to ascertain, if possible, why it should be an exception to the general rule, it will be necessary to refer to the equilibrium diagram and

* Read before the British Foundrymen's Association, Sheffield, June 21 and 22, 1918

the information it gives concerning the iron-carbon series of alloys.

The main fact to be noted is that both the melting and freezing temperatures depend on the amount of carbon in the alloy, *i.e.*, the amount of carbon in solution in the iron at the time. The lower the amount of carbon which is in solution the higher is the temperature at which the changes of state take place. The lowest freezing or melting temperature is at about 1,130 deg. Centigrade, but it is only such an alloy as has about 4.3 per cent. carbon to 95.7 per cent. iron that will freeze or melt at that temperature. An increase in the amount of either of the elements in solution results in an increase of the temperature at which the changes take place—4.3 per cent. is the saturation point of carbon in iron when these two elements are reckoned alone. With ordinary pig-irons this figure obviously requires adjustment on account of the presence, in greater or lesser quantities, of other elements. For the purpose of the present argument it may be taken for granted that foundry irons contain very near the saturation amount of total carbon. If all the carbon of a 4.3 total carbon or saturated cast iron were in solution or combined with the iron, the metal should melt or freeze about the temperature of 1,130 deg. Centigrade. Fortunately for the reputation of the cupola the carbon in pig-irons is found separated out as graphite as well as being in solution or combined in the iron.

As the melting temperature is determined by the amount of carbon in solution only in the iron at the time it reaches the melting zone, the free graphite is left out of account. It follows, therefore, that an iron which is very low in combined carbon, although high in total carbon, cannot be melted until a very high temperature is reached. The mass or body of metal will remain in the solid condition until the high temperature is attained, and consequently the liquid metal will be extremely hot. In the course of melting the free graphite is rapidly dissolved and enters into solution with the iron, with the result that the molten mass has a high percentage of combined carbon and therefore a low freezing point. Under such conditions an iron which will not melt until it has been heated to, say, 1,400 deg. C., does not freeze again until the temperature has fallen to about 1,130 deg. Such a metal may be said to have 270 deg. of life and will appear fluid.

If, on the other hand, the combined carbon in the pig-iron is already high, the temperature at which melting begins will be low, and even after the free graphite is dissolved will possess only a few degrees of life or superheat.

Another point which the writer would like to emphasise is that it is the amount of carbon in solution at the time the metal enters the melting zone, and not necessarily that of the original iron charged into the cupola that determines the temperature which will be attained in the process of melting. It has to be borne in mind that after iron has reached a certain temperature much below its melting point and has been converted into gamma iron it dissolves carbon very readily. This implies that if in the course of heating up graphite is being reduced while the percentage of the combined carbon is increasing in the iron, the melting point will be lower than indicated by the original analysis. It is obvious that in order to obtain the hottest melted metal it is essential to get the unmelted iron into the melting zone as quickly as possible. The absorption of the graphite is not instantaneous, but the rate at which it takes place increases as the temperature rises. When, therefore, the descent down the stack is slow and the metal is held above the melting zone through excessive coke in the charges, the iron is afforded an opportunity to dissolve the graphite, with the result that the material enters the zone with a lower melting temperature than it otherwise would have had. One can see from this an explanation of why excess coke results in duller instead of more fluid iron. The same explanation applies to the bed coke. If this is too high, or if the bed is so burned up that the metal is brought to a red heat, in many instances little short of actual melting, before the blast is turned on the amount of graphite that has entered into solution will be considerable, and the pig will melt at a comparatively low temperature. So long as the first charge is resting on coke which is not yet alight when the blast is turned on its combined carbon is unchanged, and the quick combustion of the coke by the blast raises the maximum temperature in the cupola before the absorption of graphite has been able to proceed very far.

The theory likewise explains the reason of the differences in the fluidity of siliceous and sulphury irons, as it is only necessary to take into account the accepted actions of silicon and sulphur with regard to the solubility of carbon in iron. Silicon by reducing the solubility makes it more difficult for the graphite to become absorbed while the temperature is being raised, while the influence exercised by sulphur is all in favour of combined carbon.

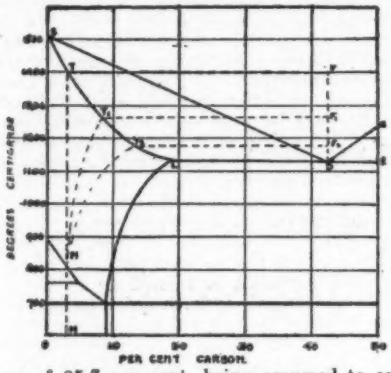
In a previous paper on the subject of semi-steel, the writer, arguing from the equilibrium diagram, advocated the use of high carbon steel, such as files, etc., because of the greater ease and lower temperatures at which such material could be melted. Experience has proved that the results to be obtained from mild or low-carbon steel are superior to those which the use of files will afford. Does not the theory here offered suggest an explanation in that the question of superheat and its source was overlooked? The high-carbon steel with all the carbon in the combined form would have a lowering melting temperature than the pig-iron itself, and its influence would be to impart a dullness to the molten mass, and so render its homogeneity more uncertain. In the case of phosphoric irons, in which the fluidity is such a marked feature, it is necessary to look to the diluting effect of the phosphide eutectic. The phosphide eutectic becomes fluid at about 950 deg. C., and so long as it remains entrapped in the otherwise solid metal it is acquiring superheat and increasing its fluidity accordingly. As this phosphide eutectic may constitute 15 per cent. or even more of the mass under treatment, the diluting effect of such a considerable volume of highly fluid material is manifest.

On the accompanying diagram an attempt is made to illustrate graphically the principal features of the foregoing remarks.

SLDE is the solidus curve of the equilibrium diagram. Any alloy of iron and carbon whose ordinates of concentration and temperature intersect below the curve can normally exist in a completely solid state. Before the alloy can become in any way liquid the ordinates must intersect above the

solidus curve. Above SDE the alloy is completely liquid and begins to solidify when the ordinates of concentration and temperature intersect on the curve.

The dotted curves represent the melting and freezing processes of an iron with 0.3 per cent. combined carbon, 4 per cent. graphitic carbon, the



balance of 95.7 per cent. being assumed to consist of iron only.

If the temperature of the solid metal is raised without change taking place in the carbon arrangement it will attain to 1,400 deg. Cent. before the metal will begin to melt, as indicated by the dotted line MNT. The curves MNT_1 and MNT_2 show the difference brought about in the temperature at which the metal begins to melt, through free carbon being absorbed in solid solution in the iron while the mass is accumulating heat. After the temperatures T T_1 T_2 have been acquired, and as the metal melts, the remaining free carbon is rapidly dissolved—indicated by TF T_1F_1 T_2F_2. The liquid solutions each containing 4.3 carbon in combination have temperatures F, F_1, and F_2 respectively, but all begin to freeze at same temperature D (1,130 deg. Cent.). The superheat or fluidity of the first is FD, which is greater than that of the second, F_1D, and still greater than that of the third, F_2D.

The foregoing statements may be summarised briefly as follows:—

The fluidity of cast iron depends on the degrees of heat which it has attained in excess of the freezing temperature.

The cupola is not suited to impart directly superheat or fluidity to any material which is being melted therein.

While the freezing temperature of foundry iron may for all practice purposes be taken as constant, viz., at about 1,130 deg. C., the melting temperature varies, and is regulated by the amount of carbon in combination or solution when the material enters the melting zone.

In view of the gradual absorption of carbon into the iron as the temperature rises the practical conclusion suggests itself that in order to obtain the molten metal in the most fluid condition the solid material in the cupola should be introduced into the melting zone as quickly as possible.

Excess of coke in the charges, too much coke in the bed or too fierce burning of the bed before blast is turned on must result in dulling the iron.

(The discussion on this paper will appear in our next issue.)

Order of the British Empire.

The King, on the occasion of his birthday last month, approved the appointment of 2,983 persons to the various classes of the Order of the British Empire. The total number of appointments made since the institution of the Order is now 5,950. The additions to the list naturally included a very considerable number of men in the iron, steel and engineering trades, amongst which we note many works managers, managing directors of companies, chief engineers, draughtsmen, etc., including the following: — *Knight Commanders.*—Lieut.-Col. A. G. Hadcock, T.D., F.R.S., managing director, Sir Wm. G. Armstrong, Whitworth & Company, Limited; Mr. J. E. Thornycroft, director, J. I. Thornycroft & Company, Limited. *Commanders.*—Mr. C. R. Lang, joint managing director, G. & J. Weir, Limited, Cathcart; Eng.-Comdr. W. H. Wood, R.N., director and engineering manager, John Brown & Company. *Officers.*—Mr. T. Fender, works superintendent, Vickers, Limited, Barrow; Mr. W. B. Turnock, manager, the Port Talbot Steel Company, Limited. *Members*:—Mr. O. Davies, steel works manager, W. Gilbertson & Company, Limited; Mr. J. Gillespie, works manager, David Colville & Sons, Limited; Mr. W. A. Hogarth, works manager, the Steel Company of Scotland, Limited; Mr. P. Longmuir, works manager, Samuel Fox & Company, Limited; Mr. A. Spicer, steel works superintendent, the Port Talbot Steel Company, Limited; Mr. G. A. Wilson, steel works manager, the Cargo Fleet Iron Company, Limited; Mr. J. Bancroft, works manager, Howard & Bullough, Limited; Mr. A. Blair, boiler shop and foundry manager, Harland & Wolff; Mr. J. Childs, head iron foreman, Swan, Hunter & Wigham Richardson; Mr. W. Dickinson, foreman engineer, Swan, Hunter & Wigham Richardson; Mr. T. Mordey, head foreman over steel workers, W. Gray & Company, West Hartlepool; Mr. H. W. Runciman, head foreman, Donkins & Company, Newcastle; Mr. G. Spiers, head foreman over steel workers, W. Gray & Company, West Hartlepool; Mr. [illegible] Thompson, foreman moulder, Blair & Company, Stockton. Mr. G. N. Shawcross (manager of the steel and iron foundries of the Lancashire and Yorkshire Railway Company, at Horwich), an Associate Member of the "B.F.A." also has been made a Member of the Order, though he is shown in the official list as acting locomotive works manager.

The above names are only a few from a long list, but so far as we can see they include the only three names which are directly associated with the foundry. It is perhaps significant of the absence of attention which the foundry as a department receives in official quarters—that is, until complaints regarding defective material have to be voiced. When consideration is given to the value of the foundryman's work in the supply of munitions, and the strenuous conditions under which the work has to be conducted, one can only come to the conclusion that the virtue of any service rendered to the State is offset by the disqualification of being a foundryman.

BASIC-BESSEMER PLANTS IN GERMANY.—In the last volume of the "Zeitschrift des Vereins deutscher Ingenieure," an article by Herr Hubert Hermanns deals with basic-Bessemer plants in Germany, according to which in all up-to-date plants the converters are arranged with their centres in a straight line, one advantage of this arrangement being that the number of converters can be increased without in any way interfering with the system of working. With converters of 20 to 25 tons capacity their distance apart is never less than about 33 ft. In the case of a 24-ton converter the bottom has 200 holes of 15 mm. (0.6 in.) bore. The bottom plug is slightly coned, its diameter being 5.91 ft. at the top and 6.23 ft. at the bottom. In some cases the outer shell is not riveted together, but entirely welded.

Venting Moulds and Cores.

NOTES FOR APPRENTICES.

By S. G. Smith.

There is no matter more important when making iron castings in sand or loam than proper and adeqüate venting. The venting of a mould or core means that channels should be provided for the free escape or passage of expanded air and generated gases, which are due to the high temperature imparted by the molten iron when poured into the moulds. In the previous article prominence was given to porosity of the sand and certain opening materials added for that purpose; but that is not sufficient. The porosity of the sand comprises only a limited number of very small and irregular lines of space or passage which must lead into a

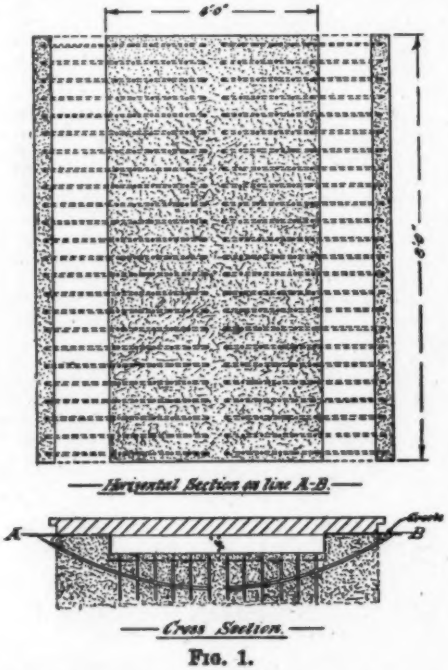


FIG. 1.

larger channel to escape freely and quickly, and, as every practical moulder knows, whether he understands the cause and effect or not, neglect to make this provision in any kind of an intricate or important casting, will probably cause a waster, or at least a casting defective or faulty in some way.

Air and gases are elastic; with few exceptions all solids, liquids, and gases expand with heat. Some of the exceptions are water (which on cooling contracts until it reaches 4 deg. C., and at its freezing point, 0 deg. C., expands); the metal bismuth—an alloy of tin, zinc and bismuth expands when cooling, or rather freezing; and india-rubber, which on being heated contracts or shortens, and on being cooled again expands.

First we will discuss the expansion of air. Roughly air is composed of 79 parts hydrogen and 21 parts oxygen. A cubic foot of air at 0 deg. C. weighs 0.0807 lbs. Each cubic foot expands 0.00366 cubic feet for each degree rise of temperature. Hence 1 cubic foot at 16 deg. C. weighs 0.076 lbs.; but at 300 deg. C. it weighs 0.043 lbs. The temperature of fairly hot cast-iron when poured into a mould is about 1,400 C., from which it will be seen that at pouring temperature the air has about five times its original volume.

FIG. 2.

We will next look at the expansion of water. The composition of water is 85 parts oxygen and 15 parts hydrogen. The increase in bulk from water to steam is more than 1,700 times, to be exact 1,728 times; *i.e.*, a cubic inch of water when converted into steam at atmospheric pressure occupies the space of a cubic foot.

There are other gases generated from some of

FIG. 3.

the ingredients in the composition of the facing and core sands, such as coal dust, manure, sawdust, oil, gum, etc. The novice may wonder what the foregoing facts have to do directly with moulding; but expanded air and gases in moulds when being poured have a power to be reckoned with. A mould when being poured is in many respects like an internal combustion engine, or a gun; with

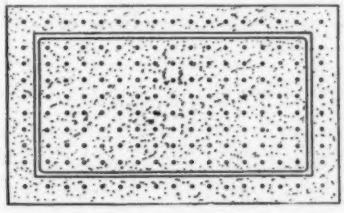


FIG. 4.

this difference, that an internal combustion engine generates and concentrates its expansive power at a critical moment for energy, while with a mould being poured these expanded gases must not be stored for a critical moment, but must be allowed a free and easy passage of escape. If any storage

is allowed to take place, then at the critical moment the mould will blow up, and the molten iron also. This is by no means a rare occurrence, and much damage to plant, injury to the men, and even loss of life has occurred from this cause at various times in foundries.

Methods for the rapid escape of the gases in moulds may now be described by means of simple sketches.

Fig. 1 is a plain plate 8 ft. long by 4 ft. wide and 4 ins. thick. The method of making such a simple casting, whether it be made from a full pattern or a frame and strickled out, would be first to level a bed either in the floor or in a box part,

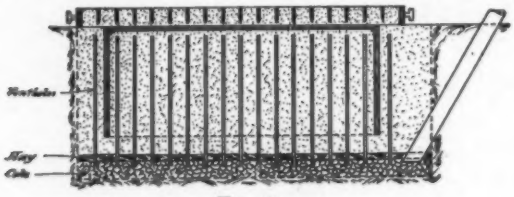


FIG. 5.

as the case may be. Now the only part of such a plain casting that requires venting is the bottom surface of the plate as it is moulded. If there should be only one such casting required, it would not be worth while putting down a coke bed, for the venting can be done as shown in Figs. 1, 2 and 3. Fig. 1 shows the end view of the plate bedded in the floor with only a top box part to cover it. When the bed has been levelled by means of strips and straight edges to the required depth for the pattern or frame, it is vented with a ¼-in. round vent wire to a depth of about 10 in., the vent holes being spaced at about 4 inch pitch. After the mould is rammed, and before the pattern is drawn out, a V groove is cut out of the sand lengthwise on the joint on both sides, the vent wire is then inserted into the sand; reaching about half-way underneath the pattern. The straight vent holes are then pierced by the side vent holes which form

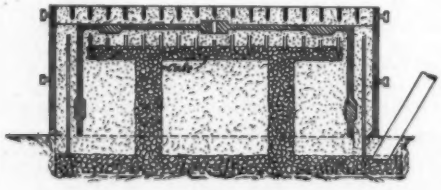


FIG. 6.

channels to carry off the expanded gases as shown in Fig. 1.

If there are several similar castings wanted, it is simpler, safer and better to put down a cinder or coke bed about 3 or 4 inches in depth, the same area as the pattern, or a little larger, allowing 6 to 8 inches of sand between the bottom surface of the pattern and the hay or straw that covers the coke bed, the depth of sand being necessary to protect this inflammable covering of the coke from being burnt from the repeated pourings in the same bed. The covering of hay or straw, or some such material is necessary to prevent the sand from filling up the spaces between the cokes or cinders of the venting bed, and so that the vent holes from the bottom surface of the mould may have free outlet through the cores to the vent pipe, as shown in Fig. 2.

If the pattern is bedded into a bottom box part, should that be deep enough, the coke bed may be put inside the box. If the box be not deep enough, then the coke bed may be underneath the box part, as shown in Fig. 3. In any case the venting of the bottom surface of the mould is similarly done, and is necessary to prevent scabbing. Care must be taken to ensure that no metal be allowed to enter any of the vents. The same applies to any kind of casting, whether in green-

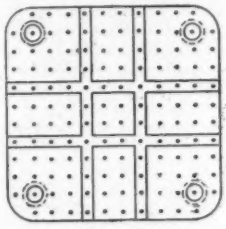


FIG. 7.

sand, skin-dried or dry-sand moulds. Where there is a large area of surface for the metal to lie upon, that part must be vented to carry off the gases.

The next example is a rectangular tank box or bosh (see Figs. 4 and 5), 5 ft. long by 2 ft. 6 in. wide and 2 ft. deep. The thickness of metal may be from ½ in. to 1 in. Many similar castings are often required. The pattern, of course, leaves its own core, which is green-sand; consequently the top of the pattern is open and the thickness of the metal strickled out.

It will be apparent that when a simple mould of this kind is poured, the generation and expansion of gases greatly exceeds that occurring with a plain plate, because there are five surfaces of molten iron in close proximity and enclosing a green-sand core, which conditions require that the gases should escape freely and quickly. The vent holes in the core should therefore be plentiful and

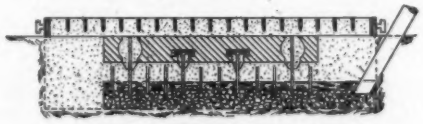


FIG. 8.

not less than ¼ in. to ⅜ in. in diameter, the coke bed should not be less than 5 ins. deep, and the vent pipe from the coke bed not less than 3 ins. inside diameter. These castings require to be poured quickly, and with very hot metal; hence there is a tendency for the air to strike upwards in the core when the mould is about half or three-quarters full, necessitating the provision for the free and easy escape of the air downwards.

Scabbing with such castings as these is quite common, and it is wise to mix a little seasand with the top layer of the core, say about 1 in. deep, then pass the needle wire over the surface into the larger vent holes. This will make the sand rather more porous where it is required, and will assist the molten iron to rest quietly on the top

surface of the core. Of course, such cores are supported by iron stakes for stability.

Fig. 6 is an example of a similar casting, but with this difference; the core is a dry-sand one which, of course, registers into a print on the pattern, the latter being made to mould for a dry-sand core. There may be some facings, bosses or other projections on both core and mould which make it necessary to mould it with a dry-sand core. Sometimes this plan avoids making a joint at the bottom of the pattern. It will be seen that when making the mould this way the core must be held down either by chaplets from the top, or from inside the core to the bottom, but it should be noted that the venting of the dry-sand core differs somewhat from that of the green-sand core.

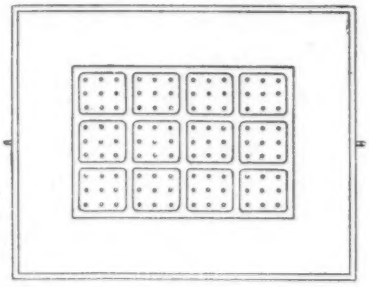


Fig. 9.

In the dry-sand core a layer of cinders, not less than 2 ins. thick, must be rammed into the core near the top surface; a small vent wire must be used from the surface of the core into these cinders, and then the sand smoothed over to close the top of these vent holes to prevent the molten iron from entering them. Also fairly large channels, not less than two in number, from the top layer of cinders to the coke bed underneath the pattern should be provided. This will ensure a rapid escape for the gases, which is necessary with a dry-sand core, as it is hard and more dense than a green-sand core. Fig. 6 will show this at a glance.

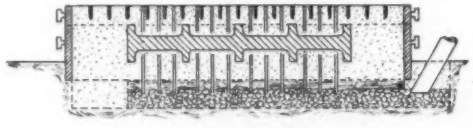


Fig. 10.

Another example of where venting must be done carefully and thoughtfully is shown in Figs. 7 and 8. This is a plate 4 ft. square by 6 ins. thick. Wherever green- or dry-sand cores are located in the bottom of a mould and a body of molten iron has to cover and lie around and upon them, to prevent scabbing, the air must have a free course to escape quickly, and this can only be done by clear vents into a thick coke bed from which the gases can make escape through a large pipe from the coke bed.

A question which often arises is whether a top part of a mould should be vented. The answer depends on circumstances. Some moulders make a habit of always venting the top parts, whether they are flat, half-round or any other shape. If you asked them why they do it, probably not 5 per cent. could give an intelligent answer. Most of them do it because others do it. It is curious how some habits in working grow and exist in certain districts and certain foundries, and seem to cling to these places, and whether right or wrong they take a lot of uprooting. The necessity for venting top parts depends upon the design of the casting In the case of a flat-back, half-round, or any similar shape it is quite unnecessary, and may sometimes do more harm than good. At the same time, there are plenty of cases where the top parts should be vented. Two simple examples are given in Figs. 9 and 10. It will be seen there are dry-sand cores in neither the top nor bottom, but the casting is of a heavy type, with thickly-set cross bars top and bottom. It is wise with such a casting as this to vent it with a vent wire in the top part.

It will be noticed that in Figs. 11 and 12 the cores which are dry-sand are hung and fastened in

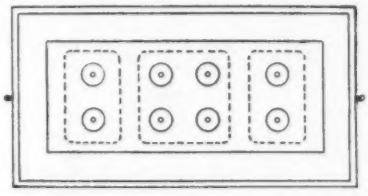


Fig. 11.

the top part, and the vents leading up from them should have small cinders around each vent channel, or be carried off by small pipes.

Figs. 13 and 14 are section and plan of a core and mould which illustrate the importance of bringing away the air quickly when the molten iron has surrounded it, to prevent an explosion resulting from enclosed expanded gases being compressed. An internal flange is carried around about midway in the core, which leaves the aperture comparatively small at this point, and the top half of the core is nearly surrounded by molten iron. Owing to that the sudden expansion of gases is intensified, while also the air has to strike downwards; so to avoid a blow-up we must provide the maximum means for the escape of these gases. In the first

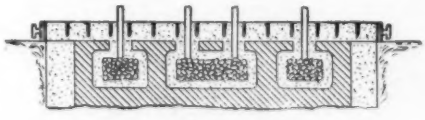


Fig. 12.

place a core of this kind, which is not uncommon, will need to be held down underneath the mould by means of a bolt through the core held by an anchor. The supporting cast irons should be made in two parts, half circular in shape, with prods on to suit the circumference of the core box, and only sufficient sand should be rammed in the top part (*i.e.*, above the internal flange) to withstand the pressure of molten iron, compatible, of course, with resisting the internal outward pressure of the expanded gases while being poured. Hence as many cinders as possible would be rammed into the core, and the channel in the narrow part between the internal flanges and also downwards to the coke bed, would be made as large as possible. In

a case of this description these precautions must be taken or trouble will follow.

Another example in some respects similar to the last one is an air vessel. This casting has to stand a very severe pressure test. No chaplets or nails of any kind are allowed to fix or hold the cores in position; consequently it must be moulded and poured vertically. As is shown in Fig. 16, the vessel is of the jacketed type. The jacket core is made in halves on a board or plate with strickles. As each half is made separately, straw ropes and small cinders are bedded into the loam through the whole length of the core. The stability of the core is attained by a specially-made core iron (shown in Fig. 17), which reinforcement is necessary for handling and withstanding the internal and external pressure of the molten iron and gases when the casting is poured, which are considerable in a jacket core of this kind. When each half of the

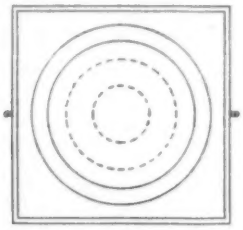


Fig. 13.

core is dried, and the vent passages are made clear, it is pasted and fastened together with small cramps; when dressed, blackwashed, and dried it is lowered into the mould, provision being made in the core iron for hanging and also for holding down in the print at the bottom, from where all the air and gases must escape, as shown in Fig. 16. When the jacket core is fixed in the print, which is its only support, the 4-in. core, which is struck upon a barrel, is inserted in the jacket core, and registers itself into the print provided in that core, also shown in Fig. 16.

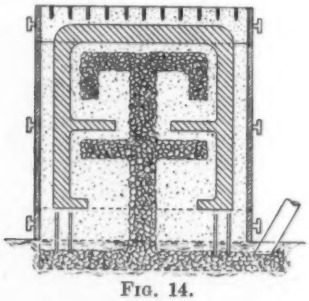


Fig. 14.

A brief reference may next be made to pipe cores. For straight pipes the cores are generally made upon barrels. The barrels are of various sizes and lengths, the larger being made in cast iron, the smaller in wrought iron. They all have a large number of holes in them, generally at about 6 ins. pitch. These holes are passages for the air to get into the barrel, and thence out at the end, when the castings are poured. Young founders will have noticed the large flame that comes out of the barrel after the castings are poured.

When making barrel cores, bands are used. They are made of either straw, hay, or fine wood shavings called "chip." These bands, regardless of the material they are made from, serve a triple purpose; besides being a convenient material for roping, they assist to hold the loam on the barrel, allow for contraction, and, what is more important still, the air and gases can pass from the loam through the ropes into the small holes in the iron barrel, and thence outward to the ends. This will be seen in Figs. 16 and 18.

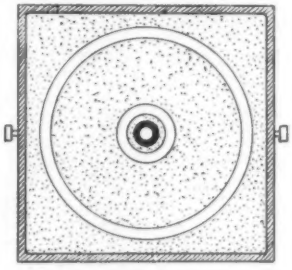


Fig. 15.

It may be remarked here that in up-to-date pipe foundries, where nearly all the castings are poured vertically, no bands or ropes of any description are used. For the small diameter core, say up to 12 ins. diameter, a special preparation of perishable loam, which contains about 50 per cent. horse

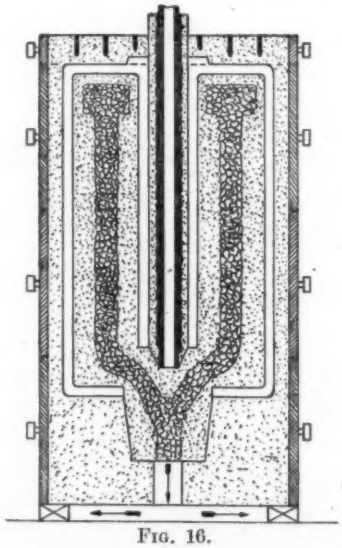


Fig. 16.

manure, is first roughed on the barrels, and when dried they are finished off with ordinary striking loam. The spongy mixture of loam allows the air to pass through to the barrel vent-holes easily, and its spongy nature allows a little contraction to occur; but the barrels must be drawn as the castings set.

For the cores of larger diameter, key, hinge, and spring and segment barrels are used. Strong clayey loam is used upon these barrels, and they are released and drawn soon after the castings have solidified. These barrels are from 10 to 14 ft. long (see Fig. 18).

With any sort of bend cores, whether large or small, channels must be made for the escape of air.

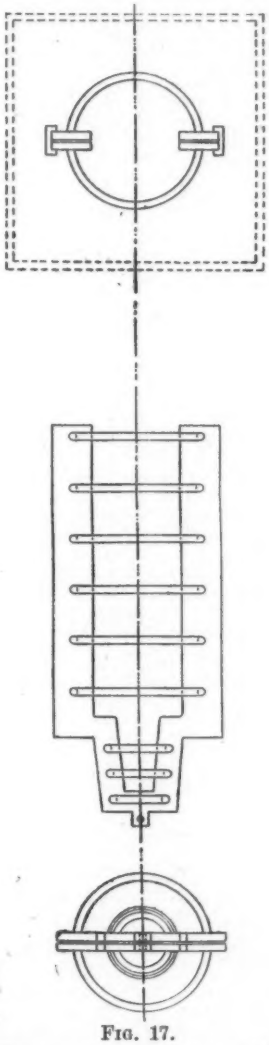


FIG. 17.

In the small cores, if made in loam, the vents are generally formed by straw ropes in either half of the core. If made in sand they are cut out before joining. With large bend cores made in loam it is wise to always put as many cinders as possible into the cores. They dry quicker, and the air comes away more freely because it has more room.

There are, of course, many kinds of cores and methods of venting that have not been referred to by the writer. Some are too complex to describe, but with all cores or moulds, whether the castings be for steam, oil, or gas engines, cylinders, pumps, valves, castings of the jacketted type, or any other design of casting, wherever molten iron has to cover, lie upon or rest against, to prevent blowing,

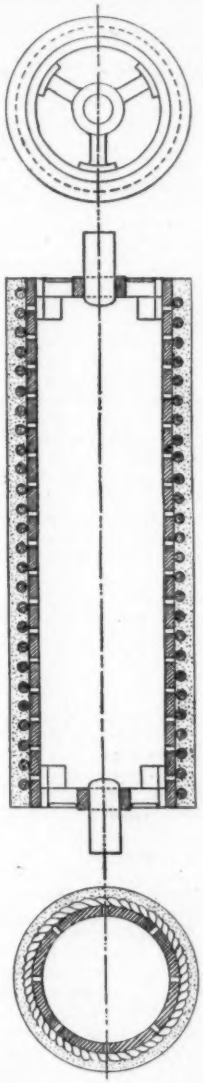


FIG. 18.

blistering or scabbing provision must be made for the escape of gases. It will be wise to look upon moulds and cores as internal combustion engines, and guns that must not go off.

MR. BRACE (Under-Secretary for the Home Department) introduced a Bill on June 19 to provide for the payment of compensation in the case of workmen who suffer death or disablement or are suspended from employment owing to the disease known as fibroid phthisis or silicosis of the lungs.

The Manufacture of Steel Castings.

In a further Paper read recently before the Manchester Association of Engineers, Mr. Ernest F. Lange continues his review of the "Development in the Manufacture of Steel Castings" which he began with a previous Paper read in January, 1917, before the same Association (see "F.T.J.," February, 1917). In his latest contribution the author gives an account of visits to foreign foundries. In the United States, for instance, he states that he found moulding practice bore a great resemblance to that on the Continent, notably to the Belgian. The best pig-iron used would be equivalent to a good Cumberland hematite; they had no equivalent of Swedish pig. The castings produced were sound, but rougher than would satisfy the European market, whilst in the production of special castings, such as locomotive bar-frames, a great degree of skill was shown. The specification requirements for steel castings, as in other steel products, were nothing like as severe as in this country, nor was annealing practised to anything like the same extent as in Europe. The annealing furnace equipment seemed quite inadequate to the output. The prices of locomotive castings obtained by the makers were distinctly less than those obtained by English makers, and more nearly resembled the Belgian and German. This would explain the absence of finish on such work, the prevalence of green-sand moulding, and the avoidance of annealing wherever possible. The small steel castings trade was being developed on Belgian and French lines, by the building of small converter plants, the majority of which were according to the system of M. Tropenas. They had no practice of tapping out small quantities out of a small open-hearth furnace.

American moulding practice, as a whole, was distinctly inferior to the best British and European for the following reasons:—(1) Less skilled labour; (2) less good moulding materials; (3) too great a speed of production; and (4) too little scientific control of the processes of annealing. On the other hand, the equipment of their best and latest steel foundries was at least equal to anything on this side. Their modern steel foundries were well-arranged steel and glass buildings, with ample floor space and excellent crane equipment. The melting furnaces were well designed, with ample length of ports, and with facilities for easy repair of the port backs, and with ample chequer chambers. Much attention was paid to the construction of the gas valves, the Forter being one of the favourite types, and a great deal of attention had been paid to improving the construction of gas producers. One of the best of these, the Hughes, was used by the Standard Steel Company.

They had not as good material as cheaply available for "acid" open-hearth melting as in this country, continued the author, and this is proved by the fact that all American specifications which include the use of "acid" material for forgings and rolled products have always higher phosphorus and sulphur limits than similar British ones would allow. In all American steel foundries they were using high percentage ferro-silicons and also carbide of silicon (corundum), and calcium silicide—also from Niagara—had been tried as a substitute for aluminium in the ladle. I saw no drying stoves or annealing furnaces fired by producer gas, although at some places they were using natural gas for one or the other. The best designed drying stoves I saw at Messrs. Pratt & Letchworth; these were coke-fired under gentle blast pressure, and the stoves had exhausters to get quickly rid of the moisture-absorbing air. The fuel for the annealing was generally coal, and the furnaces mostly of the pit type, with the roof in segments.

The moulding sands much resembled the Belgian in appearance and nature, and came either from Illinois or the Albany district of New York State. These were well mixed and sifted before use, considerable attention being paid to their initial preparation. The facing sands were mixed with stale beer or molasses, and the moulds, after well sprigging and tooling, were finished off with a paint of the very finest ground quartz silica, as fine as flour, mixed also with a little molasses water. They did not seem to have heard of tar as a finish before pouring, nor did they seem to think that with their drying-stove practice they would get sound castings with tar residue on the moulds. The wheels were moulded with pins above and below and at the sides of the spoke junctions. It was a common practice to use a spinning runner, and to bring the rising head on to a portion of the boss only, with two or three narrow risers on the rims. The test pieces were brought on to the bottom of the balance weights.

The comparison in Table I. between American and British standard specifications for railway rolling stock material may prove interesting.

As will be observed, the Americans have three classes of castings. In all the cases noted a 90 deg. bend is specified, except in the case of the American soft castings for which a 120 deg. bend is specified. The British bending test is, however, a bar 1 in. in diameter and the American 1 in. × ½ in. A very much smaller proportion of the work is tested in America than is the case here.

Table I.

	Tensile* strength	Yield point.*	Elong. in 2 in.	Contn. of area.
American standards:	Tons.	Tons.	Per cent.	Per cent.
Hard castings	37.95	17.0	15.0	20.0
Medium castings	31.25	14.06	18.0	25.0
Soft castings	26.79	12.05	22.0	30.0
British standards:				
Castings with wearing surfaces	35	—	10*	—
General castings and wheel centres	25	—	15*	—

* Minimum.

Chemical requirements were as follows:—

Table II.

Material.	American.			British.		
	S%	P%	Remarks.	S%	P%	Remarks.
Steel castings...			O.H., crucible or Bessemer			Any approved process
,, ordinary		0.08	0 40% C. max.	0.07	0.07	
,, subject to test ...	0.05	0.05		0.07	0.07	

A speciality of the steel foundry in the works of the Mesta Machine Company, Pittsburgh, was the

making of large nickel steel castings such as driving pinions for rolling mill work and special rolls. A big machine-moulded double-helicon pinion for a new 33-in. mill for Homestead was said to be of steel of the following composition :—Nickel, 3.25 per cent., carbon 0.35 per cent., silicon 0.30 per cent., and manganese 0.45 per cent. In this foundry natural gas was being used for all the three operations of melting, annealing and drying. An electric welder giving 900 amps. at 90-110 volts was employed in cutting off gits and heads up to a considerable size. Wages of the head melter ran to $175 a month. The minimum rate paid to the moulder was 36 cents per hour for a 54-hour week.

At the Union Steel Casting Company's foundry at Pittsburgh I witnessed the casting of locomotive bar-frames of the usual American type; the great difficulties involved had been most successfully overcome. A feature was the addition of vanadium to the steel for such castings; the expense of this was doubtless justified for such responsible work. The effect of the vanadium was to increase the elastic limit by about 30 per cent.; it also acted as a scavenger of the steel. From 0.1 per cent. to 0.2 per cent. was added. The annealing had to be very thoroughly done, as vanadium steel castings are more brittle than carbon steel castings in the unannealed state.

Some of the analyses of American castings which I obtained may prove interesting. They represent the very finest American steel casting practice :—

Analyses of American Steel Castings.

Kind of casting.	C.C.	Si.	Mn.	S.	P.
Wheel centre bar frame, Pratt & Letchworth, Buffalo ..	0.22	0.28	0.74	0.041	0.02
Wheel centre at Dunkirk Railway shops	0.32	0.32	0.76	0.07	—
Machine casting, Union Steel Casting Co., Pittsburgh ..	0.33	0.22	0.76	0.026	0.037
Mill housing, by Mackintosh & Hemphill, Pittsburgh ..	0.46	0.24	0.74	0.046	0.033
Mill gear wheel, by the Otis Steel Co., Cleveland ..	0.54	0.25	0.72	0.05	0.027
Hard roll casting, by the Mesta Machine Co.	1.20	0.27	0.73	0.02	0.03
Locomotive axlebox, by Pratt & Letchworth	0.36	0.25	0.89	0.042	0.023
Locomotive bar frame, by the Union Steel Casting Co. ..	0.23	0.26	0.84	0.037	—
Casting for electrical work, Westinghouse Electric Manufacturing Co., Pittsburgh ..	0.39	0.30	0.79	0.017	0.015
Locomotive Bar frame, Baldwins, Philadelphia ..	0.31	0.28	0.51	0.025	0.026
Gun-carriage casting, Midvale Steel Works	0.29	0.23	0.63	0.08	0.01
Steel casting for high magnetic permeability, General Electric Co., Schenectady ..	0.14	0.20	0.64	0.05	—

Dealing with the new-form Siemens furnace, the author states that at Cockerills, in 1913, the furnaces had been altered so as to be fired with coke-oven gas, another instance of the Belgian striving for economy; in the larger furnace the gas producer remained in case they ran short of coke-oven gas, but in the case of the smaller furnace the gas producer had been removed altogether. The usual proportions of the charge were 30-35 per cent. of hematite and 70-65 per cent. of steel scrap. The foundry had both gas and coal-fired annealing furnaces. They had an excellent gas-fired annealing furnace of the "new-form" type with movable bed. The drying stoves were coke-fired, but it was intended to fire them with coke-oven gas later on. All important and larger moulds were stoved; there was however, a lot of smaller green-sand work. They had three sand mixers of the revolving pan type, and also of the revolving screen type. They used a ball mill for grinding silica paint. They had really excellent natural sand to work with, and the mixing of these sands in various proportions had been reduced to an exact science. He had never seen locomotive wheel centres that required so little fettling as was the case in this foundry. The application of the coke-oven gases for steel melting was a fact of great technical interest. The relative composition of the three gases at Seraing was as given in the following table :—

Composition of Gases.

	Coke-oven gas.	Producer gas.	Blast-furnace gas.
	Per cent.	Per cent.	Per cent.
Hydrogen	57.00	12.00	3.00
Carbon monoxide ..	6.00	19.00	26.00
Carbon dioxide ..	2.00	8.00	11.00
Methane	23.00	2.00	—
Nitrogen..	12.00	59.00	60.00
Total	100.00	100.00	100.00

As would be seen, the coke-oven gas was similar in composition to water-gas, and from its richness and calorific effects was said to be cheaper to use than producer gas. The coke-oven gas could not be used for the drying stoves, as the hydrogen burnt to water-vapour.

The speed of melting of the steel furnaces was from three to four charges per day in either case, and this indicated sufficiently the efficiency of the coke-oven gas firing. The steel produced from the furnace was remarkably fluid, and of a very mild and tough quality. This foundry was altogether of remarkable technical interest.

Further, to the subject of this rich-gas firing, they had also adopted this in the case of a 12-ton open-hearth furnace in another part of the works. The rich gas was admitted cold, the air alone being regenerated, the regenerators being about double the usual size. It was stated that the production was four charges per 24 hours=48 tons, and that about 4,000 tons were produced in one run.

At a steel foundry in Northern France they were, in the early part of 1914, getting the following excellent results with a 5-ton Siemens "basic" new-form open-hearth furnace. No less than five charges per day of from four to five tons each were melted, according to the following time-table :—

No.	Time of charging.	Time of tapping.	Total time.
1	1 a.m.	4.30 a.m.	3 hrs. 30 min.
2	5 a.m.	8.15 a.m.	3 „ 15 „
3	8.45 a.m.	12 noon	3 „ 15 „
4	12.20 p.m	3.40 p.m.	3 „ 20 „
5	3.55 p.m.	7 p.m.	2 „ 55 „

The mixture used was as follows :—

French hematite pig	650 kilos.
Soft steel scrap	3,400 „
Final Si. and Mn. additions	54 „
Total	4.104 kilos.

In none of the above cases did the finished carbon exceed 0.20 per cent. Belgian moulding sand was used, and a large amount of work was cast in un-stoved moulds.

At another steel foundry in France, just over the Belgian border, where they had already four small converters, they had put down a new-form Siemens melting furnace (this was also just before

the war) in which they made two charges per shift easily, as the following shows :—

No.	Time of charging.	Finish of charging.	Completely melted.	Tapped at	Weight of charge.
1	6.20 a.m.	7.11 a.m.	10.20 a.m.	11.35 a.m.	5,581 kilos.
2	1.0 p.m.	1.40 p.m.	4.20 p.m.	5.35 p.m.	6,000 ,,
				Total ..	11,581 kilos

The coal used on the above occasion was 2,646 kilos, or about 4½ cwts. per ton of steel charged. The furnace hearth was composed partly of dolomite and partly of magnesite. The charges were very hot and ran about 0.15 per cent. of carbon. The moulds were mostly for mild-steel locomotive wheel centres, these being stove-dried; a lot of green-sand castings were also made from the same charge.

The above works were of particular interest, as owing to their connection with one of the most efficient and successful Belgian steel foundries working with small converters they represented every development hitherto reached in French and Belgian small-converter foundry practice, whilst since 1914 they had at their disposal open-hearth steel, which, being melted on a basic hearth, was purer and more homogenous than converter steel, and which they were able to produce almost as soft and fluid as converter steel. They might be said, therefore, to possess the last thing in respect of open-hearth practice as applied to the production of steel castings.

ELECTRIC FURNACE PRACTICE.—According to a Paper by Mr. J. K. Harrison, in the "Iron Trade Review," sulphur is extremely difficult to remove from a low-carbon bath, for the reason that only limited amount of coke can be used during the process of making a carbide slag. Steel held under a carbide slag should not be kept excessively hot unless the slag is high in sulphur. The latter has a strong affinity for iron, especially low-carbon iron, and it does not readily leave the low-carbon metal to combine with the lime in the weak-carbide slag. It is much easier to make a white or carbide slag on a high-carbon bath than on a low-carbon bath. The sulphur is more readily removed under these conditions. It is not considered practical to make steel as low as 0.08 to 0.25 per cent. carbon in an electric furnace where sulphur as low as 0.025 per cent. is desired. The electric furnace process of making steel is a competitor of the crucible process. One of the greatest advantages of the electric furnace is that low-grade scrap can be utilised. The open-hearth process requires a ratio of scrap to pig of about 80 per cent., while in the electric furnace 100 per cent. can be readily used. An electric furnace operates economically when an average grade of scrap which does not exceed 0.05 per cent. sulphur and 0.10 per cent. phosphorus is used. When scrap which contains a higher percentage of these elements is used it prolongs the process, lessens the production of metal and increases the cost of refractories and power. Machine-shop turnings, which invariably are coated with rust, should never be used in the charge, because they increase the oxides in the metal and affect the finished product. The pouring temperature, the size of nozzles, and the condition of the moulds, all play an important part in the final result. The usual procedure before pouring the molten metal is to bring the steel up to a temperature in excess of that desired for tapping and allow it to stand for ten minutes in the furnace with the power off. This procedure tends to govern the amount of carbon, which combines with the steel from the slag.

Refractory Materials Research Committee Report.

The Refractory Materials Research Committee of the Institution of Gas Engineers have issued their report for 1917-18, according to which a large amount of work has been done during the year. The preparation of special bricks for investigation purposes referred to in last year's report has been completed, and these have been tested for refractoriness, contraction, and crushing strength, and also refractoriness under load. Sets of one hundred different kinds of bricks have been fired in industrial furnaces, and five of them were removed after each firing (extending over eight days). These have now been examined for the determination of the deterioration with the different periods of firing. A considerable amount of work has also been done on the disintegration of fire-bricks by sand blast, and on the action of flue dust on refractory material. A report on the effect of load on the refractoriness of fire-bricks, etc., is appended. Reports on the influence of different kinds of flue-dust and the crushing strength of fire-bricks are being completed.

This is the first of a series of reports on the properties of refractory materials, which are expected to follow in rapid succession. The extent of the work which it has been possible to carry out is smaller than was hoped, owing to the fact that it has not been possible to obtain the services of more than one suitable whole-time assistant to Dr. Mellor. The Committee have also decided to carry out an investigation on the manufacture of fire-clay retorts by the process of "casting," and to arrange for testing of them in gasworks under ordinary working conditions.

THE MINISTRY OF MUNITIONS (Non-ferrous Materials Supply Department) have appointed the United Kingdom Rosin Distribution Association for the distribution of Government rosin. The Ministry have fixed the following prices :—American, B-G £55, H-M £56, N-WW £57 10s. per ton net cash. French or Spanish, B-G £54, H-M £55, N-upwards £56 10s. per ton.

CARBONLESS ALLOYS.—Mr. J. Kent Smith (Sheffield) in a Paper presented to the Society of Chemical Industry, entitled "A Suggestion in the Consideration of the Carbonless Metals and Alloys," dealt with metals and alloys which have been reduced or smelted from their oxides by means of a re-agent other than carbon or a carbon compound, generally by some form of aluminium reduction. After a passing allusion to Goldschmidt's processes and patents, the author briefly described the lines of alumino-thermal practice, and some of the characteristics of the metals produced thereby. He discounted the value of determination of melting points alone, and emphasised the importance rather of solubility. He suggested the influence of undissociated eutectics (in the cases under review, carbides), and, further, that eliminating difficulty of solution these eutectics probably accounted largely if not entirely for the well-known and authentically recorded differences in the employment of (a) alloys of some metals in the electric furnace and of (b) alloys of the same metals produced by alumino-thermics in making steels of quite similar final elementary analysis, such as chrome, vanadium, and titanium alloys. He earnestly begged that the efforts of advanced research students should be directed to investigation along these lines.

British Foundrymen's Association.

BIRMINGHAM BRANCH.

Steel Castings Design and Manufacture.

(*For Paper see June issue, page* 295)

Professor Turner said that owing to the war the country was short of many things, and among the things of which it was short at the present time were steel castings. Particularly required was repetition work in steel of fairly intricate shapes and of light sections. The author had referred to some of the difficulties in connection with cast iron. For many purposes there was nothing better than cast iron, and in fact nothing could replace it. For other purposes steel appeared to be absolutely necessary at the present time; cast steel, not wrought steel or machined steel. The production of these steel castings was not so much a question for the steelmaker, who knew how to make the steel; it was largely a question for the foundryman. The question of design in regard to these intricate castings was of the first importance. There were many cases in which, by a slight alteration in the design of the pattern, many of the troubles that were met with in the foundry might easily be removed without interfering with the efficiency of the finished article. Therefore the designer of the particular article that had to be produced should if possible have some knowledge of foundry work and of the questions of contraction, expansion, segregation, etc. In the manipulative work of the foundry the moulding, of course, played a very important part. The testing of the moulding sand was one of the points to which the author had referred. In the ordinary foundry, and especially in foundries of moderate size, there was not time to carry out any scientific investigation of the foundry sand; but such investigations had been carried out, and had been published as far as general principles were concerned. These publications might not describe one's own particular sand, but they described the general principles upon which a sand should be selected. As the author had told them, the ultimate researches in connection with foundry sand must be carried out in the laboratory; but still the foundryman should know the general principles which determined whether or not any particular sand would suit him, under what conditions it would stand, and so forth. But the methods of treating the sand had to be tested actually in the foundry. As to the question of encouraging the steel foundry industry in this country, if we were to take the lead in this matter it must be by having larger units and bigger furnaces, or more furnaces. We should have foundries equipped not with one electric furnace, but with five or six, or perhaps twelve, working side by side.

Mr. A. Harley (Daimler Company, Coventry) said that in his opinion the sand and the preparation of the sand for the moulds and cores was perhaps responsible for a greater amount of scrapping than any other cause. He knew very few iron or steel foundries in which the sand was dealt with properly, though most large foundries were constantly tackling the question. Of course, they wanted to use sand over again, and that brought up the very important difficulty, the question of its conveyance. The sand was prepared in a central place, and it had then to be got to the foundry floor again. The question arose whether they should rejuvenate that sand on the spot or get it away, prepare it afresh and bring it back again, which was a very expensive matter if the rejuvenating was done thoroughly and properly. There were possibilities in the idea of a group of foundries paying some intelligent person to set up a sand-preparing works which could supply sands suitable for any purpose required, ready prepared. He was quite sure that to the moderate-sized foundries this would be a blessing. The lecturer had mentioned the case of a casting with a thick section and a thin section at right angles. It often happened that a "flash" of metal would create trouble, especially on the thick side. The flash would freeze almost instantly, and this reacted on the casting as a chill at that particular spot. This acting of the flash as a chill or densener probably accounted for many mysterious happenings in the foundry.

On one point this country was very much behindhand, and that was the making of basic steel. We should never be able to compete with the basic steel produced in other countries with our present skill and mechanical methods, whether we used electrical furnaces or any other furnaces. High-quality steel made in electric furnaces, of course, had come to stay, and personally he was greatly in favour of it. He had a little electrical furnace, and after a good many initial troubles he had managed to find out the best way of working it, and he was going to put down a larger one immediately. There, again, he thought they would find that at this stage, if they were going in for electrical furnaces, that they would have to master the furnace problems of making good castings. They could not expect the people who were selling electrical furnaces to show them how to produce good castings. When one had got a decently designed electrical furnace, the best thing to do was to send away the seller of the furnace and settle down to study the problems of casting for oneself.

The speaker questioned Mr. Fletcher as to the effects of using aluminium and ferro-titanium in steel. He would also ask Mr. Fletcher whether in his experience the electrical or the oxy-acetylene method of cutting off gates and runners was more successful than mechanical methods. Coming back to the question of sand, he did not know whether Mr. Fletcher had experienced it, but he himself had found it possible to have a sand which was much too refractory for the job. The refractoriness of the sand should be correctly proportionate to the size of the casting, or rather to the thickness and bulk of the metal. If the sand was too refractory one got a rough casting. The sand should be just sufficiently refractory to bind and then to peel off when the steel contracted.

Mr. Frank Somers, speaking as a user of steel castings, exhibited two slides of his own as illustrating the importance, in his opinion, of feeding heads on steel castings. Professor Turner had mentioned the difficulty before the war of obtaining large steel castings in this country, and that the Germans were then ahead of us in producing large, sound steel castings at a reasonable price. The castings shown on the screen were the ram and stern frame respectively for a German Dreadnought. The Germans, when they made their castings, took care to have sufficient feeder heads on, so as to ensure them being sound, rather than run the risk of having to repeat the order several times before making delivery.

Mr. Westwood said he thought that a lot of the trouble in the steel castings trade was caused by foundry managers not having had sufficient chemical experience as well as practical experience. The foundry manager who had a large amount of practical experience and a fair amount of chemical experience was far more useful to the trade than a man who was a university man with any amount of theoretical experience, but whose practical experience consisted of walking through the foundry perhaps once or twice a day and handing to the foundry manager an analysis of the material he had to deal with, the foundry manager in many instances not being able to fully apply the particulars of the analysis owing to lack of chemical experience, and the chemist not able to guide him owing to lack of practical experience. Mr. Fletcher had referred to malleable castings one inch thick. Well, he (the speaker) had never yet seen a malleable casting an inch thick, although he had handled castings of that thickness supposed to be malleable. But if they examined the metal under the microscope after it had been polished and etched they would find the crystals very large in the centre, whereas at the outside they were rather small.

Another matter was the question of sharp corners. Why, when they were designing steel castings, should there be sharp corners? They were obviously of no use to anybody, either theoretically or practically. But a round corner with bold sweeps would give far stronger castings. To take, as an instance, an engine exhaust lever, some engineers expected to get a strong casting with a thickness of about three-quarters of an inch. With a good bead round the edge of it, and the casting reduced to about ⅜ in. in the middle, one could get a casting that would stand a very much higher tensile strain than one would with a casting three-quarters of an inch thick, because the structure was very much better if the casting was carefully annealed. He was referring to a malleable casting, but it was just the same with steel. In a steel casting with the corners well filleted in and all the corners rounded, they would find that the crystals would follow more definite and continuous lines than if the casting had sharp corners. It was always found that rounded corners made the casting much stronger, and a casting so designed was easier to mould, easier to cast, and far better in every respect. Sharp corners should never be allowed on a casting unless it was necessary that the two faces should meet and form a plane surface right up to the angle. Reference had been made by Mr. Harley to the effect of aluminium and of ferro-titanium. If aluminium was put into the steel ladle and the steel was poured on to it, as was the usual practice, the temperature of the steel would be raised and some of the aluminium would be oxidised to alumina. That alumina was retained in the casting and formed a certain number of cavities. When the cavities were broken into it had the appearance of slag. Some foundry managers preferred the practice of adding ferro-silicon in the ladle. But if the manganese and ferro-silicon were added in the steel furnace, to give the requisite tensile strength, the ferro-titanium should be put into the ladle and the steel poured on to it. The titanium not being oxidised, there was no residue occluded in the metal. Under these conditions segregation was lessened, and the structure of the material was closer, the crystals being much smaller, and it followed that the tensile strength would be much greater than it otherwise would be.

With metal from the electric furnace the oxygen was not occluded as in Siemens metal, nor taken out of the air as in the Tropenas furnace. The result was that with electric furnace steel practically no blowholes were got. He had had castings of over 3 ft. in diameter quite sound, also wheels weighing over 3 cwt., with teeth all round (172 teeth), and every part had turned out perfectly sound when cast in steel from an electric furnace. His experience was that the electric furnace was the best furnace for producing sound castings, and he believed that the foundry manager would have to give it the first place. It would help the foundryman to get over one of the great difficulties he had to contend with, namely, the so-called blowholes which were so often found in steel castings. Reverting to the matter of ferro-titanium, it had been found, especially in the United States, where this material was used extensively, that where it had been used as a deoxidiser the casting would galvanise much better than where another deoxidiser had been used. The following approximate analysis of the ferro-titanium referred to was given:—Silicon, 1.41; titanium, 15.79; carbon, 7.46; manganese, 0.11; aluminium, 0.80; phosphorus, 0.05; sulphur, 0.08; iron (by difference), 74.30.

Mr. D. C. Lloyd (F. H. Lloyd and Company, Limited, James Bridge), referring to what had been said about German steel castings before the war, said that the main reason why the Germans did to some extent beat this country in steel castings, as also did the Americans, was because of their use of the basic furnace. He believed he was right in saying—and it certainly was so before the war—that there was almost if not quite an entire absence of basic furnaces in the steel foundries of this country. At any rate, there was none before the war. He was talking of heavy steel castings. He thought the reason why basic furnaces had not been pushed in this country was that the Westminster engineers and the chief engineer of the Admiralty until a year or two ago specified that manufacturers must have acid steel. He thought those engineers were making a great mistake. With regard to aluminium and ferro-titanium, his firm had made a good many experiments with both. He would be very interested to hear some direct test results showing the advantages claimed for ferro-titanium. It might be that he had been entirely on the wrong track, but he had never been able to prove that ferro-titanium had the enormous advantage over aluminium or over silicate of calcium and many other things of the same sort which had been claimed for it. Aluminium undoubtedly did its job, and perhaps ferro-titanium did it as well; but as to alumina being found in steel, he thought that depended very largely on the temper of the metal. As far as he had seen, the trouble attributed to the use of aluminium was very largely exaggerated. He referred to the occluded alumina and troubles of that sort. Something had been said about cutting off the headers of steel castings with the oxy-acetylene flame, and the speaker in question had got somewhere near one of the chief troubles of the steel founder, namely, cutting off the heads. With oxy-hydrogen or oxy-acetylene he had seen some very large heads cut off, but the expense appeared to be very high indeed. The cost, he thought, depended very largely upon the man who was doing the work, and he thought there would

be a great demand in that particular industry for a man who could cut off well and economise cost in doing so. It appeared to him that cutting off and welding by oxy-hydrogen and oxy-acetylene was an industry that might well be developed apart altogether from founders, so that skilled men might be available who could do the work when it was required and with a much lower consumption of gas than was usual at present.

Mr. Fletcher, replying, referred to the question of sand. Probably Mr. Lloyd and others who had been in Germany before the war knew to what an extent the Germans had made a study of sands. He remembered on several occasions seeing the sand preparing department of Krupps' Annen works. The sand was constantly taken to a treating department, where it was dealt with just as Mr. Harley suggested it should be. Not half the sand, but every portion of the used sand, was cleared out, he believed every week-end, ready for the next week's work. The sand was dealt with, both as far as the laboratory was concerned and also in a practical sense, by remixing with fresh sand. Nothing had been said in the discussion, though he himself did mention it when speaking of small steel castings, about the value of the sand that came before the war from several of the French and Belgian valleys. Such sand was well known as having just the natural qualities that were necessary. It had up to a point the properties which those who had to deal with Tropenas work in small green sand castings required. They knew what a difficult thing it was, with the sand they now had to buy in this country, to imitate the composition they were able to get with the French and Belgian sands.

As to Professor Turner's remarks on the size of plants, he could not entirely agree with him. For instance, as far as large electric plants were concerned, he thought they might go too far in that direction. Concentration of ability in a comparatively small foundry was to his mind more likely to produce good results than the wholesale, "slap-dash" work such as prevailed in some of the big foundries. There were many big foundries in this country, where no money was spared, but where castings were none the less as rough as one could find them, and there were smaller foundries where the castings were uniformly good. The question of rising heads and the cutting off of heads was a most important matter. The Americans had used oxy-acetylene very largely in the cutting off of heads, and friends of his had told him that up to certain sizes it was possible to cut off the heads of rather difficult castings much more rapidly by this means than by any other. He himself had had experience in making very large stern frames, rudder frames and stern posts, especially sterns of the ram-head form, the heavy ram head section gradually running into a long length of thin section. There was only one way of dealing with such castings, and that was, as the Germans did, to put plenty of heads on. He did not agree that the Germans did work of that kind any better than some of our Northern foundries did it. He could name one firm where it was an exception to find anything but excellent castings, whatever the size might be, whether it was a press head or a large stern frame. The German use of the dumping method was, he thought, more largely than anything else the cause of their success in the castings business. They were able to dump their castings in this country, whilst we had been blind to the fact that it was possible to use the dumping principle to keep up the output and get a good profit. It was by that means that the German kept his foundry absolutely full. Also the Deutsche Bank backed him in every case; if he wanted money for improvement purposes it was supplied without any question. At the Annen foundry he had seen labour-saving devices of almost every known type in use. One could see this principle of labour-saving carried out in every direction. For instance, there were cutting-off machines that could be brought to the castings instead of the castings having to be taken to the machine; they had electric welding and electric cutting-off machinery, and quite a number of castings in Germany were cut off by means of the electric arc. That raised the problem of the cost of current. He believed it was possible for some of those German foundries to obtain current at not much more than one-tenth of a penny per unit. That gave the German founders advantages of which the British founders knew nothing. The use of electric furnaces and other electric appliances in this country would grow considerably when our public authorities began to understand the urgent need there was for cheaper electrical current.

The question of the value of ferro-titanium and aluminium as deoxidisers depended very largely upon how the material was used. Some people knew how to use aluminium and some did not. Success in any case depended upon whether it was used in the ladle or in the down runner from the furnace. Some people used a combination in the form of aluminium-manganese. The Germans used a tri-alloy composed of silicon, aluminium, and manganese, and he thought that he himself had something to do with the first manufacture of that alloy in this country. It was very successful in heavy steel castings if added hot or molten to the stream as it left the furnace. As to design, he thought it would repay anyone present who was a draughtsman and had to do with any kind of engineering design to consider the ratio of cooling surface to the cubic content of the metal cooled by it. The question of different sands for different moulds had largely to do with the question of expansion. Mr. Harley had mentioned that sometimes it was not the best thing to get a perfectly refractory sand and use it for all classes of castings. That was quite right. The question had to do really with the binding material in the sand. If one took a section through a sand mould facing and examined it under the microscope, there would be seen standing out small spikes of material which might or might not fuse, and whether they fused or not had a great deal to do with whether that surface was going to expand readily or contract. The expansion of the mould surface was a very serious and important matter.

With regard to basic-steel furnaces, it was quite true that the German furnaces were mainly basic. Another point might be worth mentioning in that connection. The German basic furnaces were using very large quantities of scrap. They were very hot-melting furnaces and consequently were able to use a great proportion of scrap. He knew fairly well the charges that were used in several German works, and what percentage of scrap was used, and the percentage was very much higher than was used in this country. He knew that many melters would say that it was almost impossible to use beneficially so large a proportion of scrap. An electric furnace which could melt hot enough could use plenty of scrap, and thus they were likely to get a very good material for the

production of steel castings, a material which was much more gas-free than was usually the case with other processes. Anyone who had to do with heavy steel castings and who knew how the gases rose in the feeders, would recognise the difference between steel melted in one furnace and that melted in another. Those who had seen one of these castings run in a German foundry or in the old Pilsen foundry (the Skoda) would have noticed that the metal rose in the mould just like the rising of still water. He had had many a rough time with his steel-melting friends when they had watched the same thing with castings in this country. Sometimes he had seen water poured on the top of the riser to keep the gases down in a "wild" heat.

Some Continental Testing Machines.

In our issue of May last we published this Paper by Messrs. H. S. and G. S. G. Primrose. Herewith is a summary of the discussion which followed the paper, a number of speakers commenting favourably upon the advantages of using the new methods of performing the various kinds of measurement as employed in the machines described.

Mr. F. J. Cook desired to know how it was possible to so regulate the loading of the test bar in the Amsler press that such widely varying speeds could be attained. He also wished to learn how the two pointers of the Amsler impact testing machine gave a measure of the energy absorbed in the blow.

Mr. G. B. Richards pointed out that a machine was made in this country to his design in which the measurement of the stress was done by simple pressure gauges. Although these differed from the pendulum gauge of Amsler, he quoted figures to show how the values recorded by the pressure gauge he employed agreed with results obtained with standardised lever machines. The question of the amount of oil leakage past the ram in the cylinder without cup-leathers was raised.

Mr. F. H. Lantsberry asked if the results obtained with the hydraulic method of recording pressures were now accepted by Government inspectors. He also doubted if the hardness number of a metal would be the same, depending upon whether it was determined by measuring the depth or the diameter of the impression produced by the standard ball.

Mr. J. E. Fletcher, who presided, complimented the author upon the explicit descriptions of the several types of testing machines, and made reference to the highly efficient systems of laboratory testing he had witnessed in many engineering works on the Continent.

In replying to the discussion, Mr. H. S. Primrose stated that the control of the rate of loading was effected by a finely tapered needle valve on the right-hand side of the pendulum pressure gauge, and it was according to the size of the aperture permitting the pressure oil to flow into the cylinder of the press that the ram was raised quickly or extremely slowly. The rate of loading could thus be kept steady or considerably altered during the conduct of the test. The first pointer in the Amsler impact tester indicated on its scale the amount of energy stored in the pendulum as it was raised to the release position, and the rise of the pendulum on the other side, after the blow, carried the second pointer up the other scale to the number which indicated the energy remaining in the pendulum after the test bar had been broken. The difference between these two readings was the amount of energy absorbed.

The figures quoted by Mr. Richards served to prove that with careful calibration, the pressure gauges used on his testing machine could be made to give reliable results, but frequent standardising was necessary to maintain this exactitude, which was not the case with the pendulum pressure gauge, since once set it could not readily get out of order. It was interesting to note the similarity between the British and the Swiss types of machine, but the speaker considered that the small ram in the latter would give very much less oil leakage than the larger diameter of the British type, in which no provision was made for rotating the ram.

The thoroughly scientific principles upon which the Amsler machines and pendulum pressure gauges were based, and the high skill shown in their design, construction and finish usually satisfied the most exacting inspectors at a first investigation, but to any doubters the accuracy of these machines was easily demonstrated by means of either the dead load or the standardising box to check the calibration. There was usually little or no difference between the hardness values of a metal as detetrmined by the two methods mentioned by Mr. Lantsberry, provided reasonable care was taken in the measurements, but the tendency was for the diameter method to be slightly low due to the raised ridge formed with some very soft materials.

LANCASHIRE BRANCH.

The Burning of Castings.

At a recent meeting of this Branch a discussion on "The Burning of Castings" was opened by Mr. A. Sutcliffe, of Bolton, who illustrated his remarks with a large number of diagrams and sketches explanatory of work he had done. He said burning was rarely spoken of. Why that should be so he did not know. It was certainly good in its place, because a bad casting could sometimes be made satisfactory. Not only did it help the moulder with his imperfect work; it was of service in every part of the engineering trade, and enabled many mistakes and difficulties to be got over. It was applied to making good defects, to repairing broken castings, to joining separate pieces. The method was to flow molten metal over the parts intended to be united, the hot metal being poured into channels over the junctions with outlets for the surplus metal to flow into a rut or pig mould. The mould for the burn might be either open or boxed and covered with a top part, according to whether the surface was horizontal or otherwise. The surfaces should be perfectly clean, because this made a difference to the amount of metal required. A box burn was the same as an open one, except that the channel or part mould was covered over with a top part and a runner and flow off provided. In every case the latter came off at a higher level than the casting and at a lower one than the runner. One example was a mortar mill roller which had the core lifted at one side, and also a piston block in which one core of the six cores had lifted through the top. These cores were rubbed at the parts coming to the top of the cast-

ing and the thin edges of metal broken off till it came to the casting thickness. Then a top was put on and the molten metal poured through.

In preparing some burns, the inside of the casting was rammed with sand or daubed with loam, and sometimes dried in the stove. The casting was then set in a pit or on the foundry floor in the position required for burning, and the necessary channels made up in either sand or loam. The latter might be in the form of loam cakes carded down to shape or daubed with wet loam, and then molten metal run up against the casting, a drop at a time, from a hand ladle. He thought this was the best way of heating a casting. The hotter one could get a casting before burning the better. It took less metal to burn the job. He did not think much of building fires on top of jobs. This method was adopted in one case—a cylinder body with a hole on the outside—but after two hours it was not satisfactory, and he was called in and made a good job of it. He used a little wet loam round the hole a quarter above the casting and a small well round. This was filled with metal, and when hot enough the burn was made. Half an hour was sufficient for a job like that.

THE CHAIRMAN (Mr. Key) said many valuable castings could be saved if the lecturer's advice was followed.

MR. SIMKISS said the method seemed very simple and should be of great service. Success seemed to come from having the object red-hot to commence with. If one was careful about that a good job could be made. Would Mr. Sutcliffe indicate on what basis the cost was arrived at?

MR. MEADOWCROFT said an important feature of the address was that Mr. Sutcliffe had executed all the jobs himself. One thing which often caused failure was metal lying on the floor. In his own practice he did not pour the metal on the floor. When it was ready to be poured they heated the place up in various ways, according to the job, and running from the burn they had a trough fixed in a suitable position on the floor. In this they placed a small ladle. The metal ran into this ladle. and was used again. When that was done one could put plenty of metal on without fearing that there would be a lot left on the floor. The great thing was to get rid of the oxide on the surface of the mould. A great many operations were not successful, because they did not have a suitable flux on the burning casting. With hot metal alone a great deal was required, even if it was red-hot, to make a first-class job; it was much better to get a suitable flux. For the information of the members he had brought a specimen of an article used for the purpose. It was made for blacksmiths for welding purposes, and he had found it very useful in foundry work. It was composed of ordinary fluxing materials, with a certain amount of tar worked into a cake and wire netting all the way through it. They took a piece of the right shape, put it in the bottom of the burn, filled the burn up with metal, and let it set. Immediately the metal was poured a definite reaction took place and, according to the size of the burn, there would be a thickness of slag on the top.

In replying, MR. SUTCLIFFE said the cost of burning would vary according to circumstances. If there was a lot of machining that would make a difference. Sometimes the calculation would be made in the office according to the nature of the work and material involved, but in ordinary jobs that would not be necessary.

EAST MIDLANDS BRANCH.

On Saturday afternoon, April 13, the members of the above Branch visited the Loughborough Technical Institute and Instructional Factory, where a most enjoyable and instructive afternoon was spent. The Instructional Factory is directly controlled by the Ministry of Munitions; its chief function at present is to train male and female labour in the different branches of engineering. The factory provides accommodation for between 400 and 500 employees, and it is maintained entirely as a productive organisation. Instruction is given in shell-turning, tool-setting, milling, grinding, fitting, gauge-making, smith's work, capstan and automatic machine operating, oxy-acetylene welding, pattern-making, light woodwork, metal work for aeroplane construction, drawing and tracing, inspecting and viewing, aero-engine testing, foundry practice, etc.

The lay-out of the factory is designed to be self-supporting, and to duplicate on a fair scale a complete engineering works. By the system adopted, a pupil is brought into touch with actual working conditions as a definite producer. The factory was inaugurated in January, 1916, and since that date over 1,500 workers of both sexes have been trained.

The foundry is completely equipped for the manufacture of all types of castings. The equipment consists of the following:—A 5-ton Whiting cupola (in course of construction); a 1-ton Whiting cupola (tilting); a 300 lbs. Morgan gas-fired tilting crucible furnace; a high-pressure air-blast steel furnace; a gas-fired Wright pit-type aluminium furnace; 2 Carr's crucible furnaces; two annealing furnaces for heat treatment of castings; an Ajax jolt-ram moulding machine, with turnover, etc.; Mumford, Farwell, Adaptable, and Pridmore moulding machines; a fettling bench with pneumatic exhaust; an oscillating sand-sifting machine; a "Herbert" sand-mixing machine; a tumbling barrel; sand-blast apparatus; a twin Norton grinder; a Wadsworth coremaking machine, and a core stove.

On the social side, the workers are well catered for. The works canteen is a well-equipped section, and the club room, which adjoins the canteen, is a large, comfortable room.

By the invitation of the Governors of the Institute, the members were entertained to tea, at which Principal H. Schofield presided. A hearty vote of thanks was accorded the Governors and Principal.

The annual general meeting of the Branch was held in the club room at the Technical Institute, Mr. R. T. Russell, Branch President, in the chair. The secretary's report showed the Branch was progressing under the very adverse conditions existing. The following officers, etc., were elected for session 1918-19:—President, Mr. R. T. Russell (Derby); Vice-presidents, Mr. W. G. Haslam (Derby) and Mr. H. H. Moore (Loughborough); Hon. Secretary, Mr. H. Bunting; auditor, Mr. H. Pemberton (Derby); Council, Messrs. C. W. Bigg, V. Jobson, H. Russell, H. Pemberton, F. Cooke, J. Brown, H. J. S. Hilton, K. M. Burder, J. Lucas, B. Hipkins, S. H. Russell, and E. T. Goodchild.

In the evening a meeting was held, Mr. H. H. Moore presiding, and a paper was read on "The Training of Apprentices," by H. Schofield, M.B.E. B.Sc., etc., Principal of the Technical Institute.

Trade Talk.

Mr. J. Oxley, iron and steel merchant, has removed to 131, Norfolk Street, Sheffield.

Fastnut, Limited, have removed to 49, Queen Victoria Street, London, E.C.4.

Millns Electrical Company has removed to 17, Whitefriars Street (off Fleet Street), London, E.C.4.

Theodore Butler, Limited, are removing to 139, Queen Victoria Street, London, E.C., on the 25th inst.

The address of the Foreign Trade Department is now Bridgewater House, Cleveland Square, St. James', S.W. 1.

It has been decided that the Imperial Association of Commerce shall in future be known as "The Imperial Commercial Association."

The Bosch Magneto Company, Limited, 5, Philpot Lane, London, E.C., are paying a first and final dividend of 20s. in the £.

The importation into the United Kingdom of fuses, fuse components and parts, and treadle lathes of 3-in. centres and over is prohibited.

The Trussed Concrete Steel Company, Limited, have removed to Truscon House, Cranley Gardens, South Kensington, London, S.W.7.

Messrs. Brigham & Cowan, ship repairers, of Hull, have leased land from the Corporation, near the Eastern Docks, for the erection of works.

The Rectory Engineering Company, Limited, is being wound up voluntarily, with Mr. E. J. Wilkinson, 59, John Street, Sunderland, as liquidator.

The Premier Steel Company, Limited, have established themselves in business at 28 and 29, Prudential Buildings, Sheffield, with works at Neepsend.

The "Sentinel" Wagon Works, Limited, of Shrewsbury, have acquired the works and the steam wagon business lately carried on by Alley & MacLellan, Limited.

Charles Churchill & Company, Limited, 9 to 15, Leonard Street, Finsbury, London, E.C., have been appointed distributing agents for the files made by Thos. Firth & Sons, Limited, of Sheffield.

The offices of the Aluminium Corporation, Limited, have been removed to the works at Dolgarrog, Tal-y-cafn, North Wales. An inquiry office will be retained at 4, Broad Street Place, London, E.C.2.

The Cleveland Twist Drill Company (Great Britain), Limited, 36 and 37, Upper Thames Street, London, E.C., have acquired the sole British and Continental right of the drills, etc., manufactured by the Cleveland Twist Drill Company, U.S.A.

The business of Messrs. Philipp & Lion, metal and mineral merchants, 2, Broad Street Place, London, E.C. 2, which was formerly owned by Messrs. O. I. Philipp and R. P. Lion, is now being carried on by Mr. R. P. Lion and Mr. L. Gollance under the old style, and at the same address.

The shareholders of the Brightside Foundry and Engineering Company, Limited, have approved of the scheme for the purpose of increasing the capital of the company by the creation of 60,000 new ordinary shares of £1 each, and capitalising undivided profits and distributing them amongst the holders of issued ordinary shares.

In response to inquiry, it was stated that, up to date, no detailed reply had been received from the President of the Board of Trade to the protest that had been entered regarding the suggested intention to authorise the Commission Internationale de Ravitaillement, or a like organisation, to deal with private orders in this country after the war.

The Australian Minister for Trade and Customs has decided to prohibit the importation from any country of magnetos bearing the word "Bosch." It is explained that this action has been taken in order that the Commonwealth may not be a party to maintaining a German trade-name for the ultimate benefit of German manufacturers after the war.

The whole of the shares in Thermit, Limited, which, in August, 1916, were sold by the Public Trustee to the Birmingham Metal & Munitions Company, Limited, have now been taken into their own holding by Nobel's Explosives Company, Limited, Glasgow, and under the new auspices the activities of Thermit, Limited, are being considerably extended.

The annual autumn meeting of the Institute of Metals will be held in London on September 11, when several important papers will be presented for discussion. A ballot for the election of members will be held on July 17, as a result of which the membership is expected to be brought well beyond the 1,000 mark—and that within the first decade of the Institute's existence.

Mr. Joseph Oxley, iron, steel and machinery merchant, Vicar Lane, Sheffield, has taken new and more spacious offices at 131, Norfolk Street, Sheffield, in consequence of a heavy increase in business. Mr. Oxley was, up to the latter part of 1917, a director of Thos. Oxley, Limited, of Sheffield, but severed his connections with that firm to establish himself in business as an iron, steel and machinery merchant.

Mr. A. C. Mole, liquidator of Rudman, Lancey & Craven, Limited (in liquidation), has made application for the restoration of the patent granted to H. Rudman, H. T. Lancey, and J. E. H. Craven, for an invention entitled "Improvements in and relating to hand-operated moulding machines for foundry use," numbered 15102 of 1913, and for an invention entitled "Improvements in and relating to foundry moulding boxes," numbered 15101 of 1913.

Negotiations were completed last month, whereby the shipyard of Maryport has been let, and shipbuilding will be restarted as soon as the necessary arrangements can be made. The yard has had a varied career. Owned for many years by Messrs. Ritson, who built some very fine ships there, it was afterwards taken over by Mr. Wm. Walker, engineer, who disposed of it to an East Coast firm. Soon after the war started the yard was closed down again.

Miss Stephenson has offered the Council of Armstrong College, Newcastle, the sum of £2,500 for the endowment of a studentship in the Faculty of Arts as a memorial to her father, the late Sir W. H. Stephenson. The directors and shareholders of Cochrane & Company, Limited, have offered £3,000 to be employed, in the first instance, for the award of certain scholarships in respect of persons at Middlesbrough and New Brancepeth. Both offers have been accepted.

In connection with the recent announcement that Mr. Lees Hall, one of the younger sons of Mr. I. H. Hall, managing director of the Monometer Manufacturing Company, Limited, had joined J. Lord, Limited, Manchester, who were commencing the manufacture of metal melting furnaces, we are informed by the Monometer Manufacturing Company, Limited, that the impression that the Monometer patent furnaces manufactured under Hall's patents are now to be produced at Manchester is absolutely incorrect.

In response to inquiry, it was stated that, up to the Government on account of the war, the present and future position of merchants in the iron, steel, tinplate and metal trades is receiving the Federation's earnest attention. It was decided that, in national interests, the general policy of the Federation should be to endeavour to work in harmony with the Government Departments, but it was hoped that the control that exists at present, especially so far as private orders are concerned, should cease at the earliest possible moment.

Lord Pirrie has set up in the Department of the Controller-General of Merchant Shipbuilding a new sub-department to deal with the supplies for the equipment of national shipyards and for the construction of standard ships. Mr. Harry Cocks, the head of the firm of Messrs. Harry Cocks & Company, Cardiff, has been appointed the first assistant director. The head of this department is Major W. J. Hamilton, of Messrs. Hamilton & Company, shipbuilders, Port Glasgow, and his deputy is Major J. L. Marr, of Sunderland.

In reply to GENERAL CROFT, the Minister of Reconstruction said that the steps necessary to secure an adequate supply of raw materials for British industries after the war were being dealt with by different groups of experts, who were reporting to him in respect of individual materials or groups of materials. Action had already been taken in different directions, and many of the issues involved would be submitted by the Colonial Secretary to the Imperial Conference for consideration. Regard was, of course, had to the available sources of supply in neutral countries.

SOME dissatisfaction has arisen among Sheffield manufacturers in regard to the new Small Tools Order. The Ministry of Munitions made the term "small tools" one of such comprehensive meaning that it affects, in varying degrees, practically the whole of the Sheffield industries, and manufacturers are opposed to what they regard as the inquisitorial demands of the new regulation. They have decided to proceed as though the Order were non-existent, and they have written to Mr. Churchill informing him they are not prepared to work under the order, and asking him to receive a deputation on the matter.

THE Minister of Munitions of War recently ordered that every person having any type metal exceeding 1 cwt. in amount shall send in to the Controller, Non-Ferrous Materials Supply, Ministry of Munitions, M.S./E.S., 8, Northumberland Avenue, London, W.C.2, a return of such metal, distinguishing between :—(a) Type in case, including standing matter in chase and paper, on boards, and matter awaiting distribution; (b) spacing material, including quads, quotations, metal furniture and leads; (c) electro plates and blocks; (d) stereo plates, metal and blocks; (e) linotype metal; (f) monotype metal.

A meeting of the British Federation of Iron, Steel, Tinplate and Metal Merchants was held at the Birmingham Chamber of Commerce, recently, when Sir Johnstone Wallace (Newcastle) was elected Chairman, Mr. J. Gray Buchanan (London), Vice-Chairman, and the appointment of Mr. C. T. Evennett as Secretary was confirmed. It was decided to admit members of Commerce as life members on payment of £40, and individual members, not belonging to such associations and sections, on payment of £100. The Federation is to be incorporated, and the draft of the Memorandum and Articles of Association was approved.

THE Government has issued an appeal to all skilled workers who are eligible to become War Munitions Volunteers, and who have not already enrolled, to enrol, without delay, and by doing so to place their services at the disposal of the Government for transfer, as and when necessary, to other essential war work to which they may be directed in the national interest. Similarly, workers ineligible to become War Munitions Volunteers are asked to enrol as War Work Volunteers as and when required for suitable vacancies. The Government hope that the response to this appeal to workers to enrol will be sufficient to meet the needs of the situation.

THE annual conference of the Ironmongers' Federation Association has been held at Birmingham. Mr. L. A. McGeoch, of Glasgow, in his presidential address, referring to the proposed syndication in the brass industry, which was a matter of vital importance to Birmingham, said if the ideas matured the cost of production would be lessened, and the overlapping which had taken place in the trade in the past materially reduced. He thought, however, the trade was scarcely ripe for such a radical change. The Brassmasters' Association had set their house in order, and he believed it was their intention to proceed on the lines of standardisation of patterns.

ATTENTION is directed by the Ministry of National Service to the engaging of men otherwise than through the employment exchanges, especially men of the new military age (up to fifty-one). It is emphasised that these men may not yet have been graded or medically examined, and, therefore, will not have certificates of exemption. This is not to debar them from employment through other means than the exchange, but persons so engaging them must satisfy themselves that a man is not an absentee or failing to comply with a calling-up notice. If in doubt, the employer must notify the Recruiting Office on the day he takes the man. If men placed through the exchanges turn out to be absentees the employer will not be prosecuted.

In the House of Commons, on June 4, replying to Sir J. G. Butcher, MR. WARDLE said : The partners in the firm of Ettlinger & Company are naturalised British subjects of German origin, and the Advisory Committee considered that, as an agreement between the firm and Beer, Sondheimer & Company came to an end at the outbreak of war, the business is not carried on wholly or mainly for the benefit of, or under the control of, enemy subjects. As at present advised I doubt the expediency of so widely extending Section 1 of the Trading with the Enemy (Amendment) Act, 1916, as to make it apply to all classes of such businesses, but the Non-Ferrous Metals Act recently passed covers such businesses in so far as they carry on certain essential industries.

ABOUT 400 members of the British Association of Chemists met at the College of Technology, Manchester, last month. Dr. Alfred Ree presiding, for the purpose of ratifying the formation of the new association. For many years, the Executive Committee stated, trained chemists have desired to form a strong representative organisation which will be able to speak and act with authority on the many important national and domestic problems which confronted the profession. The desire received great impetus from the war demand for chemists, and spontaneously materialised in the formation of provisional committees in various centres. It was resolved that the provisional society be terminated and that the Executive proceed with the definite formation of the British Association of Chemists.

THE BRITISH SCIENCE GUILD is organising a comprehensive exhibition of products and appliances of scientific and industrial interest which prior to the war were obtained chiefly from enemy countries, but are now produced in the United Kingdom. The Exhibition, which will be held at King's College from about the first week in August until the first week in September, will show in the first place products chiefly imported from Germany before the war, but now made in this country; but it will also illustrate the remarkable developments that have taken place generally in our scientific industries. The general scope of the exhibition has been set forth in a preliminary leaflet which has been issued, from which it is noted that the exhibits will include chemical products, thermal, electrical and optical appliances, glass, quartz, and refractory materials; photographic apparatus and material, surgical and medical appliances; and paper and textile products. Particulars may be obtained from the organising secretary, 82, Victoria Street, London, S.W.1.

ON the occasion of the King's fifty-third birthday, last month, the usual lists of honours for war and other services were published. Those of interest to the industries represented by this journal, include the following :—Viscount : The Right Hon. David Alfred, Baron Rhondda; Baron : Sir Matthew Arthur, Bart., chairman of the Lochgelly Iron and Coal Company, Limited. Privy Councillors : Sir Edward Alfred Goulding, Bart., M.P., a director of the British Westinghouse Electric and Manufacturing Company, Limited; Sir Archibald Williamson, Bart., M.P., of Messrs. Balfour, Williamson & Company. Knights : Mr. H. S. Foster, J.P., chairman of the Rubel Bronze and Metal Company, Limited; Mr. C. H. Burge, J.P., late Departmental Principal of the Government Laboratory; Mr. T. O. Callender, managing director of Callender's Cable and Construction Company, Limited; Mr. Archibald D. Dawnay, of Archibald D. Dawnay & Sons, Limited. C.B. (Civil Division) : Sir Hugh Bell, Bart., H.M. Lieutenant for the North Riding of Yorkshire.

New Companies.

Parkinson Motors, Limited.—Capital £25,000 in £1 shares.

Roclant Engineering Company, Limited.—Capital £5,000 in £1 shares.

White Mountain Silica Syndicate, Limited.—Capital £12,000 in £1 shares.

Whitworth Engineering Company, Limited.—Capital £20,000 in £1 shares.

Dovey Valley Silica Syndicate, Limited.—Capital £34,000 in £1 shares.

J. B. Holden, Engineers, Great Bridge, Limited.—Capital £5,000 in £1 shares.

Hill & Partners, Limited.—Capital £20,000 in £1 shares, to carry on the business of engineers.

Glover & Main (Birmingham), Limited. — Capital £10,000 in £10 shares, to carry on the business of gas meter manufacturers.

British Engineering Company (London), Limited.—Capital £2,000 (1,900 10 per cent. ordinary of £1 and 2,000 deferred of 1s.).

Centrifugal Air Blast Company, Limited.—Capital £10,000 in £1 shares. Registered office: Old Bank Chambers, Wolverhampton.

Lewis Speed-up Tool & Engineering Works, Limited.—Capital £1,000 in £1 shares. Registered office:—2a, Kelvin Road, Highbury, N.5.

Victoria Metal and Engine Ring Company, Limited.—Capital £1,000 in £1 shares. Registered offices: Imperial Buildings, Kingsway, W.C.

Fraser Johnston Engineering and Ship Repairing Company, Limited.—Capital £25,000 in £1 shares, to take over the existing business at Aberdeen.

Thomas Smith & Sons (Rodley), Limited.—Capital £150,000 in £1 shares (50,000 preference). Registered office: The Steam & Electric Crane Works, Rodley, near Leeds.

Isaiah Woodall & Sons, Limited.—Capital £10,000 in £1 shares, to take over the business of a brass and iron founder carried on by I. Woodall at Dudley, Worcs.

Plaskynaston Foundry, Limited.—Capital £3,000 in £1 shares, to take over the business carried on by T. Longdin, N. C. Longdin, and F. P. Owen at Acrefair, near Brabon.

Victoria Metal and Engineering Company, Limited.—Capital £1,000 in £1 shares. Chairman and managing director, A. C. V. Jenkin. Registered office: Imperial Buildings, Kingaway, W.C.

Anti-Rust and Metal Deposition Company, Limited.—Capital £11,000 in 4,000 preference and 7,000 ordinary shares of £1 each. Registered office: 73, Granville Road, Cricklewood, N.W. 21.

J. A. Prestwich & Co., Limited.—Capital £200,000 in 50,000 six per cent. cumulative preference and 149,500 ordinary shares of £1, and 10,000 management of 1s., to carry on the business of engineers.

Dee Smelter, Limited.—Capital £6,000 in £1 shares, to adopt an agreement with A. W. Lewin. The first directors are A. W. Lewin and G. H. Alexander. Registered office: Abbey Works, Holywell.

Martyn Brothers, Limited.—Capital £10,000 in £1 shares, to acquire the business now carried on by Martyn Brothers, Chapelside Engine Works, Airdrie. Registered office: 127, St. Vincent Street, Glasgow.

Engineering Timber Company (Liverpool), Limited.—Capital £300,000 in £1 shares (100,000 preference, 100,000 preferred ordinary, and 100,000 deferred ordinary). Registered offices: Cunard Building, Pierhead, Liverpool.

Metallurgists, Limited.—Capital £12,000 in 6,000 7½ per cent., tax free, participating preference shares of £1 each, 5,000 ordinary shares of £1, and 10,000 deferred shares of 1s. each. Registered offices: 35, Long Acre, W.C. 2.

National Spring Company, Limited.—Capital £1,000 in £1 shares, to take over the business carried on by J. A. Harvey at Fountain Works, Fountain Lane, Oldbury (formerly Spon Lane, West Bromwich). Registered office: Fountain Works, Oldbury.

Richard Jones Rolling Mills, Limited.—Capital £25,000 in £1 shares, to take over the business of a metal roller carried on by A. Williams at the New Rolling Mills, Garrison Lane, Birmingham. Registered office: Garrison Lane, Birmingham.

Ormerods' Tool Company, Limited.—Capital £30,000 in £1 shares, to take over the business carried on at Valley Iron Works, Hebden Bridge, as Ormerod Brothers. The first directors are H. Ormerod, H. Ormerod, J. Ormerod, and G. T. Ormerod.

Charles W. Taylor & Son, Limited.—Capital £100,000 in £1 shares, to take over the business of engineers, being carried on at North Eastern Foundries, Temple Town and Largate, South Shields, as Charles W.Taylor. Permanent governing director, C. W. Taylor.

W. Westley & Sons, Limited.—Capital £10,000 in £1 shares, to take over the business of a brassfounder and manufacturer of mill, forge and engine bearings carried on by W. Westley, sen., at Shaw Road and Vicars Street, Dudley, as W. Westley & Sons.

Ward & Smith, Limited.—Capital £2,000 in £1 shares, to carry on the business of manufacturers, importers, and exporters of and dealers in iron and steel of all descriptions. The first directors are H. H. Ward and R. C. Smith. Registered offices: Congo Works, Trippet Lane, Sheffield.

Alloy Welding Process, Limited.—Capital £120,000 in £1 shares (20,000 cumulative preference), to enter into agreements with the Russo-British Finance Company, Limited, and with E. J. Jones. The first directors are E. H. Jones (managing director), W. A. Hunter and F. W. Poyner.

Rowland Needham & Company, Limited.—Capital £50,000 in £1 shares, to take over the business of steel, metal and alloy manufacturers, formerly carried on by T. Dobb as Rowland Needham & Company, at Ferro Works, Wadsley Bridge, Sheffield. T. Dobb is permanent director.

Monometer Manufacturing Company (1918), Limited.—Capital £16,000 in £1 shares (15,000 8 per cent. cumulative preference), to take over the business of engineers, etc., lately carried on by the Monometer Manufacturing Company, Limited, at Birmingham The first directors are H. J. Thomas and W. H. Gould.

F. G. Pearson & Company Limited.—Capital £8,000 in £1 shares, to take over the business of manufacturers of and dealers in light and heavy edge tools, formerly carried on by J. B. Mickelthwate and H. H. Norton as F. G. Pearson & Company. Gregory & Company, and James Wall & Company, at Hope Works, Furnace Hill, Sheffield. The first directors are J. B. Mickelthwate and H. H. Norton.

Associated Brass & Copper Manufacturers of Great Britain, Limited.—Capital £50,000, to carry on business as manufacturers, factors of copper, etc., and to export to China (including Hong Kong). The first directors are C. J. R. Bedford, Birmingham; E. C. Clark, Manchester; J. W. Earle, Birmingham; K. Fraser, Leeds; W. W. Gibbins, Birmingham; E. Mapplebeck, Birmingham; Sir Gerard A. Muntz, Birmingham; and A. W. Wolseley, Birmingham.

Wigan Electro-Metallurgical Works, Limited. — Capital £50,000 in £1 shares, to acquire from W. B. Hamilton, H. A. Blackwell, and W. L. Turner their interests in an invention relating to grey cast iron, and to carry on the business of ironmasters, etc. The subscribers (each with one share) are: H. A. Blackwell, Whyte House, Bispham, Blackpool, metal merchant and mine owner; W. L. Turner, Purley, Caldey, Ches., company director; W. E. Hamilton, 32, Grosvenor Road, Birkdale, metallurgical chemist; A. W. Blackwell, Sparlands, Argyle Road, Southport, metal merchant; George G. Blackwell & Sons, Limited, 46, The Albany, Liverpool; Blackwell's Metallurgical Works, Limited, 46, The Albany, Liverpool; British Thermit Company, Limited, 49-51, The Albany, Liverpool; E. S. Blackwell, Rossett, Bankfield Lane, Southport, metal merchant. The first directors are:—H. A. Blackwell and W. L. Turner (governing directors).

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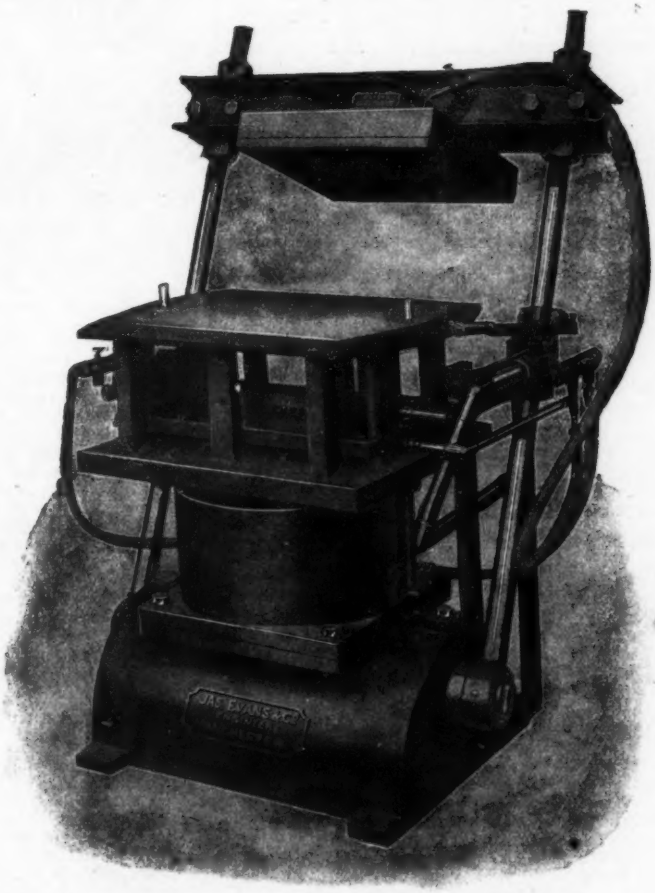

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Applications for Patents.

The names of communicators are printed in Italic type. A new number will be given when the Complete Specification is accepted.

Akt.-Ges. für Autogene Aluminium Schweissung. Autogenous welding of aluminium or its alloys. 8,874. May 29.

Alldays & Onions Pneumatic Engineering Company. Appliances for use with oil-fuel burners. 8,843. May 29.

Bloom, A. Device for filling moulds with molten metal. 8,619. May 24.

Böckman, O. C. Electric induction furnaces. 8,273. May 17. (Norway, October 12, '17.)

Böckman, O. C. Furnaces, etc. 8,274. May 17. (Norway, November 27, '17.)

Britannia Foundry Company. Grinding machines. 8,114. May 15.

Burgan W., and Winder, B. W. Machine for testing hardness of metals. 9,045. June 1.

Clarke, W. B., and the Edison Swan Electric Company. Treatment of refractory metals. 9,023. May 31.

Crowcroft, A. Furnaces. 8,137. May 15.

Crowcroft, A. Cast-iron shell-forging stamping pad. 8,180. May 16.

Dresden, G. Soldering metals. 8,568. May 23.

Driver-Harris Company. Melting pots or crucibles. 9,210. June 4.

Fletcher, T. M. Armour plate. 9,183. June 4.

General Electric Company. Electric furnaces. 8,509. May 22.

General Electric Company. Production of steel alloys and constituents thereof. 9,267. June 6.

General Electric Company. Manufacture of steel. 9,268. June 5.

Gibbons Brothers and Masters, R. Furnaces for heating metal articles, etc. 8,040. May 14.

Griffith, F. W. Die-casting machine. 8,055. May 14.

Hadfield, Sir R. A. Remelting manganese steel scrap. 9,354. June 6.

Head, Wrightson & Company and Ringquist, J. M. Blast-furnace stoves. 8,586. May 23.

Kuehnrich, P. R. Furnaces. 8,611. May 24.

McWane, J. R. Cast-iron pipe. 8,248. May 16.

Morris, F. Furnaces. 8,137. May 15.

O'Donnell, J. P. Powdered fuel, and process of treating same. 8,310. May 17.

Sarron, P. F., and Simon, J. Electro-converter furnaces, and process of treatment for manufacture of steels thereoy. 8,761. May 27.

Smeaton-Wright Furnaces, Limited. Gas-fired furnaces. 8,309. May 17.

Stokes, F. W Casting machines. 9,006. 9,007. 9,008. 9,009. May 31.

Legal.

Hulme v. Ferranti, Limited.

In the King's Bench Division, before Mr. Justice Shearman and Mr. Justice Sankey, the above appeal from the Oldham County Court was heard. It raised a new point under the Munitions Tribunals Acts as to the jurisdiction of County Courts to determine claims for wages by workmen. The plaintiff was an iron-moulder and a member of the Ironfounders' Society. The plaintiff was employed by defendants at £2 14s. a week, but owing to a strike the defendants closed their works from May 3 to May 11, 1917. Although the plaintiff was not one of the strikers he was refused work during that period, and he claimed the amount of his wages for that week. The County Court Judge found for the plaintiff on the ground that there was an implied undertaking by the defendants to provide the plaintiff with a reasonable quantity of work between May 3 and 11, 1917 The defendants appealed from the decision of the County Court Judge on two grounds; first, that the plaintiff was not entitled under this alleged statutory term of his contract to receive a week's notice and to be provided with a reasonable quantity of work during the period from May 3 to 11. 1917; secondly, that the only remedy (if any) that the plaintiff had was before the Munitions Tribunal, under the Munitions of War (Amendment) Act, 1916, section 5, sub-section (3).

Mr. Justice Shearman, in giving judgment, said that it was well settled that where a special statutory tribunal was set up in that way other Courts had no jurisdiction. The defendants were therefore right in their contention that the County Court Judge had no jurisdiction to hear the plaintiff's claim, as it could only be heard by the Munitions Tribunal. The appeal should be allowed. Mr. Justice Sankey gave judgment to the same effect. The appeal was accordingly allowed and leave to appeal was refused.

Alleged Offence of Metal Refiner.

An appeal by J. Wilson, metal refiner, Glasgow, against a conviction in the Sheriff Court at Glasgow, has been heard, on a charge of having, on February 9 last, in his possession or under his custody or control 76 lb. of brass which was reasonably suspected of having been stolen or unlawfully obtained. The pursuer's register bore, "February 9, 8.40 a.m., John White, 19, Dalmarnock Road—76 lb. brass borings—£1 16s." The police failed to trace the alleged John White, and found that there was no such number in Dalmarnock Road. Sheriff-substitute Boyd was of opinion that the statement of the appellant as to how he came by the brass was not satisfactory, and convicted him, fining him £10, with the alternative of six days' imprisonment. The Court dismissed the appeal.

Our Parliamentary correspondent states that in support of the War Office appeal for 15,000 vounteers for special service for a period of two or three months, Mr. G. Terrell, M.P., has sent a strong appeal to the Federation of British Industries and the National Union of Manufacturers pointing out this is the first occasion upon which the Government has asked the Employers' Association to help them in finding men. The number required is so small that Mr. Terrell feels certain that by a little energetic investigation it will be found that the men can be spared. It is far better, he says, that the employers should select and arrange with the volunteers who are in their service than that the men should be taken regardless of the inconvenience and dislocation which is bound to ensue if they are taken by the Government direct. Generally speaking, it will be arranged that a man's position as regards military service is not affected in any way adversely by his having performed whole-time volunteer service under the scheme. The Federation of British Industries has passed a resolution recommending its members to assist in the demand of the War Office.

Head, Wrightson & Company, Limited, have in hand the construction of two Wrightson-Ringquist mechanical blast furnace chargers for Baldwins, Limited, South Wales, and one for Bell Brothers, Port Clarence. The chargers for Baldwins, Limited, are each guaranteed to carry 20 skips per hour, the ore carried per skip being equal to 8 tons, while in the case of the charger for Messrs. Bell Brothers, the skip capacity equals 6 tons of ore. Both are electrically driven with Ward Leonard control. A feature in the hoist for Baldwins is a steadying arm, which prevents the skip from swinging, and by this means the capacity of the hoist is considerably increased. In this type of hoist the tail sheaves are held in position by means of tension weights, instead of being rigidly fixed. By these arrangements, the tension in the hauling ropes cannot exceed the pre-determined amount; the bogie on the charger is operated by two hauling ropes, each one being capable of carrying the full load in the event of a breakdown to one of them. To minimise the amount of power to operate this charger, the weight of the skip and load is balanced by a counter-balance weight. The upper end of the charger is supported on independent legs, and not on the furnace casing, as has hitherto been the custom, it having been found that the latter method causes a disturbance in the furnace, which is apt to set up heat spots.

TABOR

Box and Mould—after being Rammed—in position of being Rolled over.

Portable,

Combination,

Shockless Jarring,

Roll-over

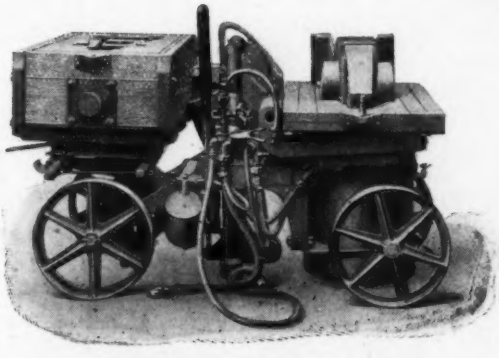
AND

Pattern - Drawing

MOULDING MACHINE.

Capacities and Dimensions upon application to

Sole Manufacturers and Agents:



The Finished Mould—showing Pattern after being drawn.

MACNAB & CO.,

56/8, Eagle Street, Southampton Row, London, W.C.1.

Personal.

THE council of the Society of Chemical Industry have awarded their medal to Professor Sir James Dewar, F.R.S.

MR. EVAN WILLIAMS, of Glyn-Dwr, Pontardulais, has been elected a director of the Rhymney Iron Company, Limited.

MR. J. F. COWAN, the manager of Messrs. Hawthorn, Leslie's cruiser department, has been appointed manager of the Admiralty National Shipyard at Chepstow.

MR. E. OLIVER, secretary of Ruston, Proctor, & Company, Limited, Lincoln, has been the recipient of a presentation from the directors, on his having completed 50 years' service with the firm.

MR. G. N. SHAWCROSS has been made a Member of the Order of the British Empire, in recognition of his war services as Manager of the Steel and Iron Foundries of the Lancashire and Yorkshire Railway Company at Horwich.

A PEERAGE of the United Kingdom has been conferred upon the Right Hon. Sir William Weir, Secretary of State for the Air Force. Sir William Weir is managing director of the engineering firm of G. & J. Weir, Limited, of Glasgow.

MR. ROBERT MASON has been elected M.P. for the County of Northumberland, Wansbeck Division, in the place of the Right Honourable Charles Fenwick, deceased. Mr. Mason is a director of the Shields Engineering & Dry Dock Company, Limited.

CAPT. HAROLD BELL, the King's Own Royal Lancaster Regiment, awarded the Military Cross, is the elder son of Mr. A. Bell, J.P., of Redthorpe, Lancaster, a member of the firm of Messrs. A. Bell & Sons, millwrights and steel merchants, etc., Lancaster.

MR. J. L. TWADDELL, who has been general manager at the Jarrow Shipyard of Palmers Shipbuilding & Iron Company, Limited, for 19 years, and who has been connected with the firm for 26 years, has retired into private life. He has been the recipient of a presentation from the officials and men.

THE Managing Commission of the Comité des Forges de France has elected M. F. de Wendel as their President. M. de Wendel is the Lorraine ironmaster whose mines and works have been seized by the Germans and handed over to German concerns. Messrs. E. Schneider and Pralon are Vice-presidents of the Committee.

MR. T. S. SIMPSON, yard manager to Earle's Shipbuilding & Engineering Company, Limited, of Hull, has been the recipient of a presentation from the officials and men on his departure to take up the position of general manager of the repairing department of Palmers Shipbuilding & Iron Company, Limited, Jarrow-on-Tyne.

MR. J. E. FLETCHER, of Dudley, recently president of the Staffordshire Iron and Steel Institute, and a member of the council of the Iron and Steel Institute, has been elected a member of the Faraday Society, as a result of a recent communication to the Society of Chemical Industry on the "Super-heating of Metals and of Slags in Smelting and Refining Operations."

MR. E. W. DELACOUR, publicity manager of the Anglo-Mexican Petroleum Co., Ltd., has been elected President of the Society of Motor Advertising Managers for the ensuing year, in succession to Mr. E. E. Reinhold, of the Vacuum Oil Co. Mr. Hubert C. Davies, of John I. Thornycroft & Co., has signified his willingness to continue the duties of hon. secretary and treasurer of the Society.

THE KING has given permission to Sir John Hunter, K.B.E., Director of Factory Construction and Director of Iron and Steel Production, Sir Leonard Wilkinson Llewelyn, K.B.E., Controller of Non-Ferrous Materials Supply, and Mr. William Turner MacLellan, of the Ministry of Munitions, to wear the Cross of Officer of the Legion of Honour, which Decoration has been conferred upon them by the President of the French Republic in recognition of services rendered.

AS SUPPLIED TO H.M. WAR OFFICE.

THE ORIGINAL AND BEST CORE COMPOUND.

"SPERMOLIN"

(Registered Trade Mark.)

For particulars apply to the Makers :—

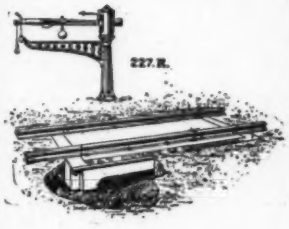
THE SPERMOLIN CORE CO.,

George Square,

HALIFAX.

Telegrams :—"SPERMOLIN, HALIFAX." *Telephone :—397 Halifax.*

AVERY



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OF EVERY DESCRIPTION FOR EVERY PURPOSE.

Dust Fan.

High Pressure Fans.

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Fans for Ventilation, for Dust Removal, for Induced & Forced Draft on Boilers.

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FANS

Cupola and Forge Fire Fans for large or small duties. Reliable and efficient.

Davidson & Co., Limited.,

Sirocco Engineering Works.

BELFAST.

Deaths.

Mr. H. Booth, of the Deal Foundry, Amblecote, died recently.

The death is announced of Mr. J. Page, agricultural engineer, Wimborne.

Mr. J. Graven, engineer, of Ely, Cambs., died last month at the age of 73 years.

The death took place recently of Mr. H. Turner, a director of Joseph Downham, Limited, mill furnishers, Bury.

Mr. Greenwood, of Greenwood's Standard Gear Cutting Company, Limited, Halifax, died recently at the age of 81 years.

Mr. J. R. Rogers, iron merchant, of West Hartlepool, died recently, aged 44 years.

Mr. W. Richardson, managing director of the Meadow Foundry Company, Limited, of Mansfield, died recently.

The death has occurred of Mr. A. S. Chew, of Mitcheldean, at the age of 59 years. He was a partner in the firm of Teague & Chew, engineers, Cinderford.

The death has occurred at his residence, Moseley, of Mr. W. H. Bagley, of the firm of Samuel Heath & Sons, Limited, general brassfounders, Birmingham, at the age of 56 years.

On June 1 last the death was announced of Mr. T. D. Wilkes, of The Furlongs, Sedgley. The deceased, who was 56 years of age, was the managing director of the Atlas Bedstead Company, Limited, Bilston.

We regret to announce the death, which took place at Bath, of Mr. C. H. Halcomb, who for many years resided in Sheffield. Mr. Halcomb, who was in his 87th year, had enjoyed good health up to quite recently. In 1869 Mr. Halcomb was elected managing director of the firm of Sanderson Brothers & Newbould, Limited, steel manufacturers, Sheffield, and this position he held until 1894, when he retired.

The death is reported of Mr. H. B. Law, J.P., who for many years was chairman of Henry Rossell & Company, Limited, steel makers, Sheffield. Mr. Law was the son of the late Mr. Abraham Law, of Brocco Bank, Sheffield. He became apprenticed to Messrs. Rossell & Company in 1856, and a partner in 1875. Shortly after the death of Mr. Rossell, Mr. Law became sole proprietor, and in 1891 he amalgamated his business with that of Mr. J. Dickson, of Messrs. Dickson Brothers & Company. The business was then transferred to the Waverley Works, Effingham Road, Sheffield, where it has been carried on ever since. Mr. Law, who for a long time acted as representative of the firm throughout Scotland, retired from active work in 1900. He was in his seventy-ninth year.

By the death of Mr. Robert Stephenson, J.P., at the age of 86, Middlesbrough, has lost a prominent citizen. As a boy the late Mr. Stephenson entered the service of Messrs. Losh, Wilson, & Bell Bros., at Walker-on-Tyne, but about the time when the works of Bell Bros. at Port Clarence were in course of erection it was thought advisable to transfer him to this part of the country, and he became attached to the commercial staff in 1854. Later he accepted a post with the Stockton Malleable Iron Company, and became managing director, a post for which he was well fitted, and which he held for nine years. On the occasion of his retirement owing to illness in June, 1891, he was the recipient of a presentation from the officials and workmen. Up to this time Mr. Stephenson had also carried on in the Royal Exchange a business as a metal merchant, which he established in 1863.

SOMETHING NEW FOR METAL MELTERS AND ENGINEERS.

Crucible Problem Solved.

THE NON-CRUCIBLE ELIPTICAL TYPE FURNACE,

For melting STEEL, PIG-IRON, Ferro-Manganese, Copper, Brass, Aluminium and all other Ferrous and Non-ferrous Metals.

☞ **Most Rapid and Economical System To-day.**

500 to 2,000 lbs. capacity. (CAN BE USED AS A CONVERTOR.)

For full particulars apply:
MONOMETER MANUFACTURING CO. (1918), Ltd.,
WHITEHOUSE STREET, ASTON, BIRMINGHAM.

Chairman: H. J. THOMAS, Esq.
Managing Director: I. HALL, M.I.Mech.E., M.I.S.I.

FERRO-VANADIUM. * * * * **FERRO-TITANIUM.**
SILICO-MANGANESE { **23/30** % Silicon. / **65/70** % Manganese and **1** %, **2** %, **3** %, Carbon Maximum.
FERRO-SILICON Containing **25** %, **50** %, **75** % Silicon.
FERRO-CHROME **65/70** % Cr. & **1** % up to **8/10** % Carbon Maximum.
MAGNESIUM METAL **99** %. *In Sticks and Powder and Magnesium Copper.*

WE SUPPLY ALL CLASSES OF MINERALS, METALS AND METALLIC ALLOYS.

EVERITT & CO., 40, CHAPEL ST., LIVERPOOL.

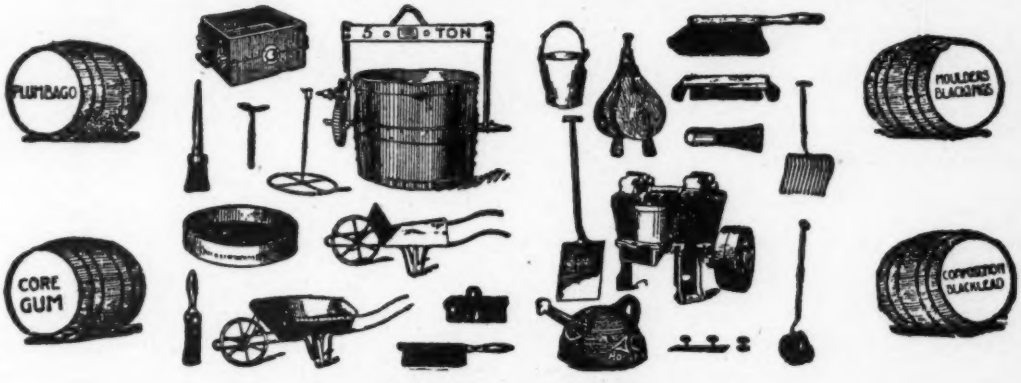
Telegrams: "PERSISTENT." Telephone No. 1134 (3 lines).

Telegrams: "Durrans, Penistone." Telephone: 21, Penistone

Established 1863.

JAS. DURRANS & SONS,

Phœnix Works, Penistone, Near Sheffield.



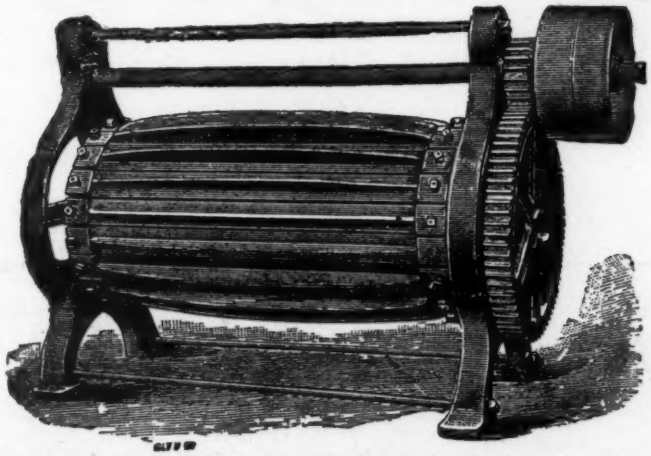
Manufacturers of all

FOUNDRY EQUIPMENTS

COMPOSITION BLACK LEAD, PLUMBAGO, CORE GUM, WHITE DUST & COAL DUST

Ladles, Cupolas, Fire Bricks, Gannister, Stone Flux, Loam and Sand Mills, Casting Cleaners, Studs, Chaplets, Pipe Nails, Sprigs, Brushes, Wire Brushes, Core Ropes, Bellows, Buckets, Spades, Forks, Riddles, Sieves, Barrows, Etc.

Improved Foundry Rattler or Fettling Drum.



These Machines are invaluable for a Foundry, doing a larger amount of work of a superior quality, in a much shorter time than can be done by hand, without skilled labour.

The following testimonial explains itself :—

"Dear Sirs,—We have been using your best Blacking for a large number of years, and always use it on our large Ingot Moulds, which, as you know, we have made up to 85 tons in weight.

Yours faithfully, THE BRIGHTSIDE FOUNDRY & ENGINEERING CO., LD.

MONTHLY PRICE LIST.

The undermentioned prices, unless otherwise specified, are those obtaining at the commencement of the current month.

CONTROL PRICES.

Pig-Iron.

	£ s. d.
West Coast hematite, mixed Nos. 1, 2 and 3	6 7 6
Special under 0.03 P. & S.	6 15 6
" " 0.02 "	7 0 0
East Coast hematite, mixed Nos. 1, 2 and 3	6 2 6
Special under 0.04 P. & S.	6 7 6
Special under 0.03 P & S.	6 15 6
" " 0.02 "	7 0 0
Scotch hematite, mixed Nos. 1 2 and 3	6 2 6
Special under 0.03 P. & S.	7 10 0
Welsh hematite, mixed Nos. 1, 2 and 3	6 2 6
Special under 0.03 P. & S.	6 15 6
" " 0.02 "	7 0 0
HEMATITE—MALLEABLE—Refined—	
Refined Cupola Cast	8 0 0
Refined Cupola Cast to guaranteed analysis	8 5 0
Cast direct from Blast Furnaces—	
Small Pig-Iron, all grades	7 10 0
Medium Pig-Iron White to Grey mottled	7 5 0
Medium Pig-Iron, all other qualities	6 17 6
Large Pig-Iron, all grades	6 17 6
Lincolnshire, basic or foundry	4 17 6
Cleveland, No. 1	4 19 0
" other grades	4 15 0
" basic	5 0 0
Northamptonshire, forge	4 7 6
" fdy. numbers	89/0 94/0
" basic	4 17 6
Derbyshire, forge	4 10 0
" foundry numbers	92/6 96/6
Derby & Notts. basic.	4 17 6
Leicestershire & Notts., forge	4 10 0
" " foundry nos.	92/6 98/6
North Staffs, forge	4 15 0
" " foundry	4 17 6
" " basic	4 17 6
South Staffordshire—	
Part mine forge	5 0 0
" foundry	5 2 6
Common Staffordshire	4 15 0
All mine forge	5 15 0
" foundry	6 0 0
Warm air forge	7 5 0
" foundry	7 15 0
Lord Dudley's silicon	8 7 6
Cold blast	9 2 6
Basic	4 17 6
Scotch foundry and forge—	
Nos. 3, 4, and lower grades of Monkland, Dalmellington, Eglinton, and Govan	5 14 0
Nos. 3, 4, and lower grades of all other brands	5 15 6

No. 1 quality in all cases to be 5s. per ton above these prices.

All per ton net, f.o.t. makers' works. Mers. Com. 1½%

In all districts 1s. extra may be charged for Basic cast in chills.

High-Speed Tool Steel.

The maximum prices for high-speed tool steel have been fixed as follows:—

Finished bars, 14% Tung. 3s. 8d.

Finished bars, 18% Tung. 4s. 5d.

Per lb. basis. Extras as per authorised list. These prices are net delivered buyers' works.

The fixed prices for scrap which must be returned to steel makers' works are as follows:—

Millings and Turnings .. .. 8d.

Bar Ends .. .. 9d.

Both per lb. net delivered steel makers' works.

Ferro-Alloys

Net, Delivered Sheffield steel works.

	£ s. d.
Ferro chrome: 4/6% carbon. Basis 60%, scale 10s. per unit Per ton	—
Ferro-chrome: 6/8% carbon. Basis 60%, scale 10s. per unit. Per ton	—
Ferro-chrome: 8/10% carbon. Basis 60% scale, 10s. per unit Per ton	—
Ferro-chrome: Specially refined, guaranteed maximum 2% carbon broken to small pieces for use in best quality crucible steels. Basis 60%, scale 32s. per unit. Per ton	—
Ferro-vanadium: 33/40% Va., per lb. of Va. contained in the alloy	—
Ferro-silicon: 45/50%. Basis 50%, 5s. scale per unit .. Per ton	—
Ferro-titanium: 23/25%, per lb. carbonless	—
Ferro-molybdenum: 70/80% Mo. per pound of Mo. contained	—
Ferro-phosphorus: 20/25%. Per ton	—
Ferro-tungsten: 75% to 80% per lb. of metallic tungsten contained	—
*Ferro-manganese 80%	26 10 0
" export	—

* F.o.b. Liverpool.

Non-Ferrous Metals.

Copper.

	£ s. d.	£ s. d.
Standard, Cash	122 0 0	122 10 0
Three months	122 0 0	122 10 0
Electrolytic	137 0 0	133 0 0
Tough	135 0 0	131 0 0
Best selected	135 0 0	131 0 0

Tin.

	£ s. d.	£ s. d.
Standard, Cash	339 0 0	340 0 0
" Three months	339 0 0	340 0 0
English Ingots	340 0 0	—
Bars	341 0 0	—
Refined	—	—

Spelter.

	£ s. d.	£ s. d.
American	54 0 0	50 0 0
Specials	—	—
Hard	45 0 0	46 0 0
British	56 10 0	57 0 0

Lead.

	£ s. d.	£ s. d.
Soft Foreign (net)	29 10 0	28 10 0
English	—	Nom.

Antimony.

	£ s. d.
Regulus	85 0 0

Aluminium.

Virgin Metal 98/99% per ton	—

Phosphor Bronze.

INGOTS.	Per ton.
Alloy No. I. or II	—
III., IV. or V.	—
VI. or VII.	—
VIII.	—
XI.	—
Cast Strips and Ingots	—
CASTINGS.	**Per lb.**
I. or II.	—
III. IV. o V.	—
VI. or VII	—
VIII.	—
XI.	—
No. VII., Chill, Cast, Solid	—
" Cored Bars	—

Delivery 2 Cwt. free to any town.

10 per cent. Phosphor Copper .. £50 above price of best selected copper.

15 per cent. Phosphor Copper .. £70 above price B.S.

Phosphor Tin (5 per cent.) .. £30 above price of English Ingots.

(Phosphor-bronze prices supplied by CHARLES CLIFFORD AND SON, LIMITED, FAIRLEY STREET MILLS, BIRMINGHAM).

***Chromium (Metallic).**

98/99% purity, per lb. — —

***Nickel.**

In cubes, 98/99% purity Per ton —

Nickel Silver.

	per lb.
Ingots for raising	—
Ingots for Spoons and Forks	—
" rolled to spoon size	—

***Tungsten Metal Powder.**

96/98% purity.. per lb. —

***Molybdenum Metal.**

96/98% purity.. per lb. —

***Cobalt Metal.**

97% purity .. per lb. —

Quicksilver.

75 lb. bottle —

* Net, Delivered Sheffield Works.

Scrap Iron and Steel.

Cleveland.

	s. d.	s. d.
Steel scrap, heavy melting	—	—
Iron scrap cast (cupola metal)	—	—

London (f.o.b.).

Heavy steel	104 6
Light "	55 0
Heavy cast	110 0

Control Prices.

Heavy Steel Melting Scrap 105 0	125 0
Steel Planings, Turnings and Borings	65 0
Steel Planings, Turnings and Borings mixed with Wrought Iron, &c.	50 0
Steel Scrap, all other Classes	95 0
Wrought Iron Scrap	125 0
Ditto, mixed with Steel	95 0
W.I. Planings, Turnings and Borings mixed with Steel, &c.	50 0

Per ton delivered Buyers' Works.

Non-Ferrous Scrap.

London merchants quote the following prices for scrap metal, delivered London, and subject to market fluctuations:—

	A. Joseph. £ s. d.
Hy. Electrolytic Copper Scrap	—
Hy. Selected Scrap Brass	—
Hy. Tinned Copper Wire	—
Best Selected Gunmetal Scrap	—
Re-melted Ingot Lead	—

Stocks.

Metals.

	Tons.
Copper, Europe and afloat	—
Tin, London, Holland, U.S.A. and afloat	18,653

Coke.

Middlesbrough.

	s. d.	s. d.
Gas Coke	36 0	—
Foundry	52 6	—

Glasgow.

Foundry Coke	—	45 0
Furnace Coke	35 0	—
Gas Coke	—	

London.

Welsh or Durham Foundry, d/d London Stations in truck	45 0	53 0
Ditto, d/d Birmingham Stations	44 0	48 0
Yorkshire, d/d London Stations, in truck	42 6	—
Ditto, d/d Birmingham Stations	39 6	

CONTROL PRICES OF COKE.

	s d.
Durham and Northumberland blast furnace	33 0
" foundry	38 0
Yorkshire, Lancashire, Staffordshire, Notts., Derbyshire, Lincs., & Midland Counties blast furnace	32 0
South Wales blast furnace	37 6
" foundry	50 6

All per ton net. f.o.t. ovens.

Cumberland blast furnace	37 9
d/d West Coast furnaces	

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GENTLEMAN desires partnership in up-to-date Iron Foundry business; 25 years' practical experience. Capital, and excellent connection in the Manchester district.—Address, Box 955, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

PATTERN MAKER.—Permanent position offered to suitable man in small controlled works, preferably one with experience in pattern-plate making for moulding machines. 50-hour week. No person already on Government work will be engaged.—Apply, your nearest Employment Exchange, mentioning No. A5353.

QUALIFIED CHEMIST, with well-equipped private Laboratory, is open to receive samples of Iron, Fuels, etc., for analysis. Accuracy and promptness guaranteed.—Apply, Box 954, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

PRACTICAL Foundry Manager, with engineering and metallurgical qualifications, capable of organising and managing on modern lines foundry for high-grade Iron and Bronze Castings; commercial experience; highest references; desires appointment immediately.—Address, Box 982, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

MOULDERS wanted, used to light aluminium and brass castings, for Aero Engine work, for large Aircraft Factory in North-West London.—Apply, stating age, wages and experience, to Box E. M., c/o W. H. Smith & Son, 55, Fetter Lane, E.C.4. No one engaged on Government work or residing more than ten miles away need apply.

FOUNDRY CHARGE HANDS WANTED.—Government Controlled Non-Ferrous Jobbing Foundry in Midlands require services of two men thoroughly acquainted with casting Gunmetal, Manganese and Phosphor Bronze, to act as working charge hands. Must have had similar experience, able to control men and organise output.—Apply, Box 978, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

FOUNDRY MANAGER (Grey Iron), West Riding Yorkshire, to take entire charge practical side; 20 tons per day repetition Government work of importance. Must have held similar post before; sound organiser and able to mix by analysis. Suitable remuneration will be paid and assured position after the war to a first-class man. State age and qualifications. No person engaged on Government work can be engaged.—Box 984, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

PIG IRON and FOUNDRY MACHINES.—Agencies wanted for France after the War by Commercial Engineer Agent.—Please answer to DESHERCES ALBAN, 6, rue de l'Hôpital, Angoulême, Charente, France.

VERZOCCHI & DE ROMANO
MILAN (Italy).
Importers of
MINERALS. METALS. ALLOYS.
also
REFRACTORY MATERIALS and all requisites for the Engineering Trades.
Correspondence Invited.

FOR SALE AND WANTED.

WANTED, Sand Blast Apparatus, in good working order.—Replies, stating age, condition, price, maker's size, etc., to Box 950, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

CORE MAKING for IRON CASTINGS.—(1) Makers or suppliers of Notched Wire; (2) Makers or suppliers of effective Core Binders—Linseed Oil substitutes.—Address, Box 980, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

WANTED, PIFTIN BLOWERS, all sizes. Please send particulars of where same can be seen. Advertisers are prepared to purchase any quantity.—Write, Box 968, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

SLIGHTLY Defective Corrugated Asbestos CEMENT ROOFING SHEETS, permanent, cheap, and for immediate delivery.—W. PATTISON, Widnes.

ROTARY TABLE SAND BLAST MACHINES, second-hand, required for urgent Government work. Diameter of table 70 ins.; capacity 20 tons iron castings per hour.—Send all particulars to Box 976, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

F. L. HUNT & CO..
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FOUNDRY REQUISITES
Of every description.
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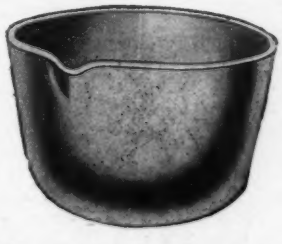
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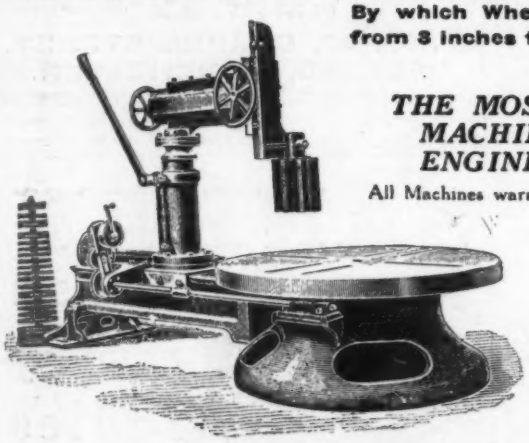

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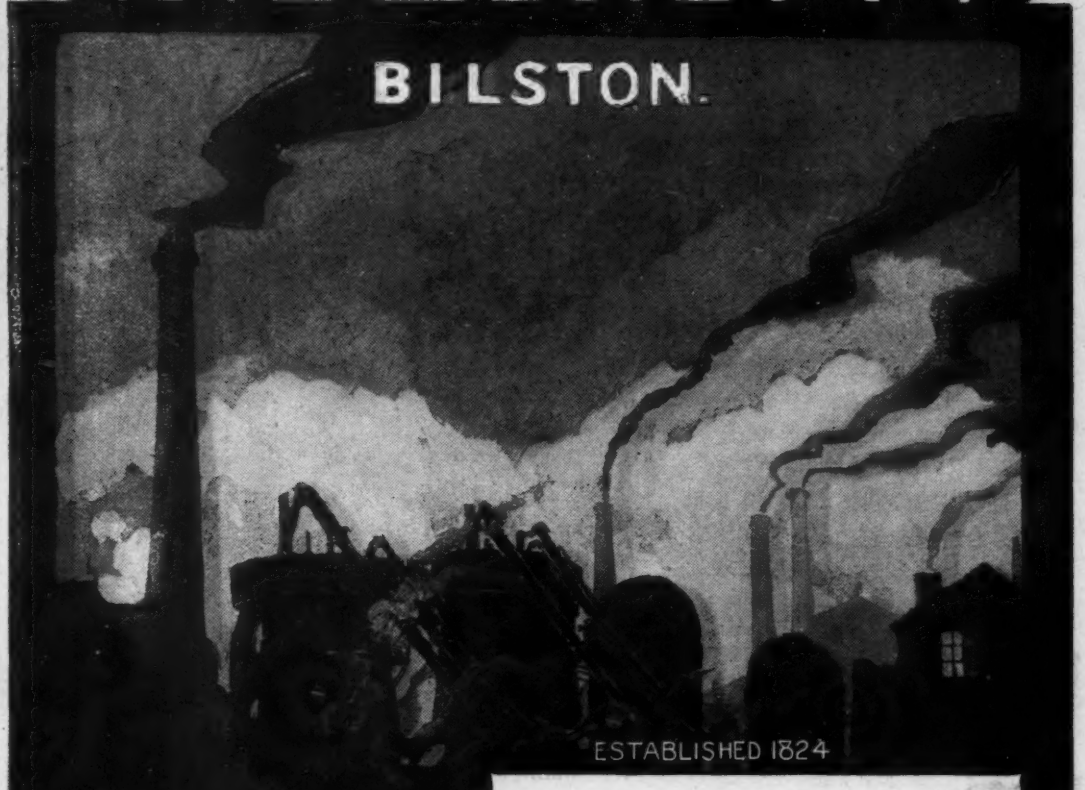

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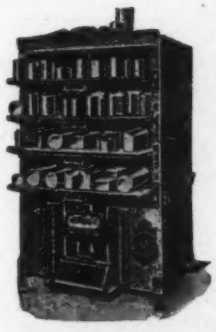

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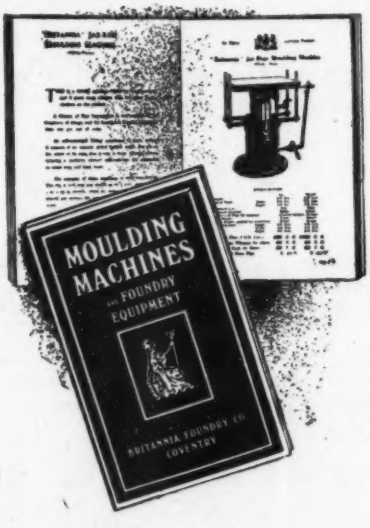

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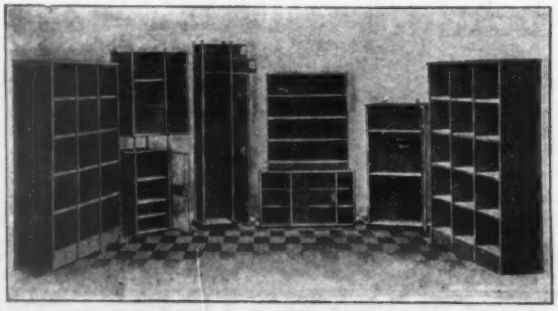

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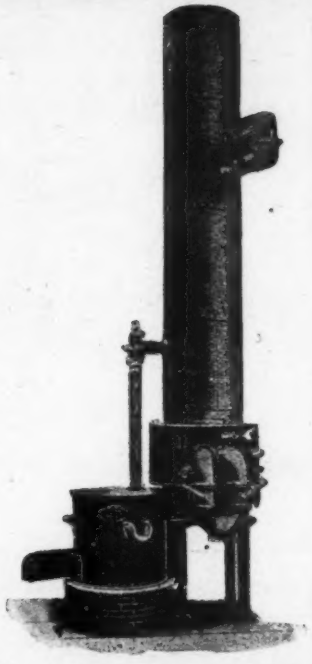

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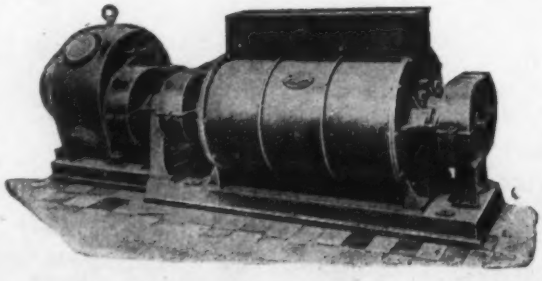

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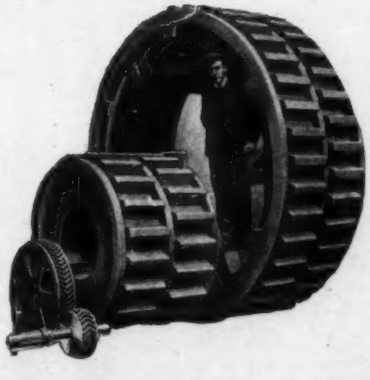

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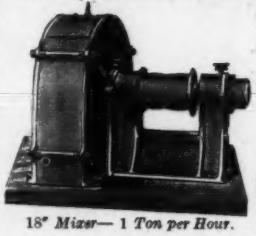

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